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The scleractinian corals of Moreton Bay, eastern Australia: high latitude, marginal assemblages with increasing species richness

Carden C. Wallace, Ida Fellegara, Paul R. Muir and Peter L. Harrison

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ERRATUM: MEMOIRS OF THE QUEENSLAND MUSEUM — NATURE 54(1)

New species of Raspaillidae (Porifera: Demospongiae: Poecilosclerida) from southeast Queensland

Hooper, J.N.A., Sutcliffe, P. & Schlacher-Hoenlinger, M.A.

Text to be added at the end of page 22 of *Memoirs of the Queensland Museum — Nature*, volume 54(1).

TABLE 1. Comparisons in the range (and mean) spicule measurements between *Raspailia (Raspailia) scorpa* sp. nov. and the allied *R. (R.) phakellopsis* Hooper 1991.

Material	Ectosomal styles	Choanosomal styles	Subectosomal styles	Echinating acanthostyles
R. (R.) scorpa sp. nov. (holotype QMG315208)	210-350 × 1-2 µm (315.8 × 1.9 µm)	290-460 × 10-11 µm (378.0 × 11.0 µm)	1000-1600 × 5-13 µm (1288.6 × 9.0 µm)	80-140 × 4-5 µm (125.8 × 4.9 µm)
R. (R.) phakellopsis (holotype NTM Z1950)	173-302 × 0.5-3 µm (231.0 × 1.5 µm)	311-465 × 9-8 µm (392.7 × 13.2 µm)	820-1835 × 8-17µm (1349.6 × 12.4 µm)	125-156 × 5-9 µm (133.2 × 7.1 µm)

TABLE 2. Range (and mean) of spicule measurements in *Raspailia (Raspailia) kennedyi* sp. nov.

Material	Choanosomal styles	Subectosomal styles	Ectosomal styles (anisoxeas)	Echinating acanthostyles
Holotype QMG317177	350-830 × 9-12 µm (497 × 8.53 µm)	900-1200 × 7-9 µm (1077 × 8.2 µm)	140-290 × 1-2 µm (203.50 × 1.66 µm)	50-70 × 4-6 µm (61.43 × 4.9 µm)

TABLE 3. Range (and mean) spicule measurements in specimens of *Aulospongus similiaustralis* sp. nov. and comparison with related species of *Aulospongus*.

Material	Choanosomal styles	Subectosomal tylostyles	Echinating acanthostyles
Holotype QMG300079	230-380 × 9-20 µm (300.3 × 10.8 µm)	690-1120 × 4-10 µm (925.6 × 9.7 µm)	70-255 × 2-8 m (97.9 × 4.4µm)
Paratypes QMG315526	150-350 × 8-20 µm (248.3 × 11.8 µm)	780-1260 × 10 µm (974.6 × 10 µm)	60-120 × 5-7µm (87.3 × 5.1µm)
QMG317317	210-435 × 10-20 µm (342.1 × 16.1 µm)	800-1200 × 6-11 µm (955.7 × 9.4 µm)	82-150 × 5-10µm (101.2 × 6.8µm)
QMG320085	180-370 × 6-20 µm (292.2 × 14.1 µm)	720-1110 × 6-10 µm (932.2 × 8.7 µm)	65-130 × 3-6µm (85.4 × 4.6µm)
Specimens QMG304007	150-340 × 12-20 µm	950-1300 × 8-15 µm	85-125 × 4-5 µm
QMG304879	240-370 × 10-20 µm	850-1050 × 10-15 µm	80-130 × 6-12 µm
QMG303963	190-345 × 15-20 µm	800-1100 × 5-10 µm	80-120 × 5- µm
QMG317276	310-430 × 18-20 µm	900-1250 × 5-10 µm	80-125 × 7-11 µm
QMG306292	270-440 × 8-25 µm	790 1200 × 4-11 µm	80-165 × 5-10 µm
QMG315777	280-400 × 4-10 µm	900-1410 × 6-15 µm	90-130 × 6-8 µm
QMG315732	270-370 × 9-18 µm	700-1400 × 5-15 µm	80-130 × 5-7 µm
QMG315610	175-390 × 7-20 µm	800-1350 × 4-16 µm	80-130- × 3-5µm
A. tubulatus (Bowerbank 1873) (data from Hooper *et al.* 1999)	304-462 × 16-24 µm	Absent (ectosomal styles: 212-250 × 2-3 µm)	109-126×5-10 µm

TABLE 4. Range (and mean) spicule measurements for specimens of *Echinodictyum luteum* sp. nov.

Material	Primary choanosomal oxeas	Secondary choanosomal oxeas	Echinating acanthostyles
QMG304769 holotype	205-440 × 5-11µm (269.8 × 7.37µm)	140-320 × 2-6µm (204.8 × 3.76µm)	90-135 × 4-7µm (117.6 × 4.84µm)
QMG317152 paratype	150-580 × 5-13µm (247.5 × 8.75µm)	110-425 × 1-7µm (223.8 × 3.96µm)	105-130 × 3-8µm (115.6 × 5.96µm)
QMG306395 paratype	200-500 × 4-11µm (287 × 6.12µm)	170-400 × 1-2µm (220.27 × 1.33µm)	120-180 × 4-8µm (141.48 × 5.6µm)

TABLE 5. Updated checklist of Raspailiidae recorded from Australian territorial waters (1, Dampierian Province, Geraldton (Western Australia) to Cape York (Queensland). 2, Solanderian Province, Cape York (Queensland) to Coffs Harbour (New South Wales). 3, Peronian Province, Coffs Harbour (New South Wales) to shallow coastal regions of northern Victoria and deeper waters off northeastern Tasmania. 4, Maugean Province, Bass Strait and shallow waters of Tasmania. 5, Flindersian Province, western Victoria to Geraldton (Western Australia). 6, Australian Antarctic and subantarctic Territories. Provinces after Bennett & Pope (1957). Data modified and updated from Hooper (1991).

Species	1	2	3	4	5	6	Other locality
Raspailia (Raspailia) atropurpurea (Carter, 1885)			×	×			
Raspailia (Raspailia) echinata Whitelegge, 1907			×				
Raspailia (Raspailia) kennedyi sp. nov.		×					
Raspailia (Raspailia) gracilis (Lendenfeld, 1888)			×				
Raspailia (Raspailia) phakellopsis Hooper, 1991	×						
Raspailia (Raspailia) pinnatifida (Carter, 1885)				×			
Raspailia (Raspailia) scorpa sp. nov.		×					
Raspailia (Raspailia) tenella (Lendenfeld, 1888)			×				
Raspailia (Raspailia) vestigifera Dendy, 1896	×			× ?			
Raspailia (Raspailia) wilkinsoni Hooper, 1991		×					New Caledonia, Vanuatu
Raspailia (Clathriodendron) arbuscula (Lendenfeld, 1888)	×		×				New Zealand
Raspailia (Clathriodendron) bifurcata Ridley, 1884	×	×	×				
Raspailia (Clathriodendron) cacticutis (Carter, 1885)				×			
Raspailia (Clathriodendron) darwinensis Hooper, 1991	×						
Raspailia (Clathriodendron) desmoxyiformis Hooper, 1991	×						
Raspailia (Clathriodendron) keriontria Hooper, 1991	×						
Raspailia (Clathriodendron) melanorhops Hooper, 1991	×						
Raspailia (Clathriodendron) paradoxa Hentschel, 1911					×		
Raspailia (Raspaxilla) compressa Bergquist, 1970	×	×			×		New Zealand
Raspailia (Raspaxilla) frondula (Whiteleggge, 1907)			×				
Raspailia (Raspaxilla) reticulata Hooper, 1991		×					
Raspailia (Raspaxilla) wardi Hooper, 1991	×						

TABLE 5. continued ...

Species	1	2	3	4	5	6	Other locality
Raspailia (Parasyringella) australiensis Ridley, 1884	×	×					
Raspailia (Parasyringella) clathrata Ridley, 1884		×					
Raspailia (Parasyringella) elegans (Lendenfeld, 1887)	×						
Raspailia (Parasyringella) nuda Hentschel, 1911	×						
Raspailia (Parasyringella) stelliderma (Carter, 1885)				×			
Raspailia (Hymeraphiopsis) irregularis Hentschel, 1914						×	
Aulospongus similiaustralis sp. nov.		×					
Sollasella digitata Lendenfeld, 1888			×				
Sollasella moretonensis Van Soest, Hooper, Beglinger & Erpenbeck, 2006	×	×					
Ectyoplasia frondosa (Lendenfeld, 1887)	×		?				
Ectyoplasia tabula (Lamarck, 1814)	×				×		
Ectyoplasia vannus Hooper, 1991	×						
Endectyon elyakovi Hooper, 1991	×	×					
Endectyon fruticosum aruense (Hentschel, 1912)	×						Indonesia, Thailand
Endectyon thurstoni (Dendy, 1887)	×						E coast India
Endectyon xerampelina (Lamarck, 1932)							Unknown, possibly Australia
Trikentrion flabelliforme Carter, 1882	×				?		Indonesia, PNG
Cyamon aruense Hentschel, 1912	×						Indonesia
Eurypon graphidiophorum Hentschel, 1911					×		
Amphinomia sulphurea Hooper, 1991	×						
Ceratopsion dichotomum (Whitelegge, 1907)			×				
Ceratopsion axiferum (Hentschel, 1912)	×						Indonesia
Ceratopsion clavatum Thiele, 1898		×					Japan, New Caledonia, Papua New Guinea
Ceratopsion montebellocnse Hooper, 1991	×						
Ceratopsion palmatum Hooper, 1991	×						New Caledonia
Thrinacophora cervicornis Ridley & Dendy, 1886	×						Indonesia, Philippines
Axechina raspailioides Hentschel, 1912	×						Indonesia
Echinodictyum arenosum Dendy, 1896				×			
Echinodictyum asperum Ridley & Dendy, 1886	×	×					Indo-Pacific, Tahiti to Gulf of Manaar, Chuuk to northern Australia
Echinodictyum austrinus Hooper, 1991					×		
Echinodictyum cancellatum (Lamarck, 1814)	×	×					Indonesia
Echinodictyum carlinoides (Lamarck, 1814		×					Indonesia
Echinodictyum clathrioides Hentschel, 1911	×				×		
Echinodictyum conulosum Kieschnick, 1900	×	×					
Echinodictyum costiferum Ridley, 1884		×					

TABLE 5. continued ...

Species	1	2	3	4	5	6	Other locality
Echinodictyum fruticosum Hentschel, 1911	×						
Echinodictyum lacunosum Kieschnick, 1898		×					
Echinodictyum luteum sp. nov.		×					Palau
Echinodictyum mesenterinum (Lamarck, 1814)	×	×	×	×	×		Indo-west Pacific: Philippines, New Caledonia, Singapore, Malaysia, Vietnam
Echinodictyum nidulus Hentschel, 1911	×				×		
Echinodictyum rugosum Ridley & Dendy, 1886	×						Indonesia

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COVER: Underwater seascape from Moreton Bay with inserts *Acropora valida* and *Favia favus*.

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PREFACE

The present monograph comprises the second of three volumes that present the results of research undertaken during the Thirteenth International Marine Biological Workshop on the Fauna and Flora of Moreton Bay, held from the 7–25 February 2005 at the Moreton Bay Research Station, Dunwich, North Stradbroke Island. The first volume was published in December 2008 in the *Memoirs of the Queensland Museum* volume 54(1). The excellent study on the corals of Moreton Bay presented here has been many years in genesis, but we have claimed it as part of the Proceedings because the Workshop allowed all authors to come together for a sustained period of field work, and indeed was a significant catalyst that allowed this work to be completed.

The Workshop was organised by the Southeast Queensland Branch, Australian Marine Sciences Association, and in particular Peter Davie, Julie Phillips, Ian Brown, Mara Wolkenhauer, Ian Tibbetts and Nerida Wilson. Much needed sponsorship was provided by the Queensland Government (Queensland Museum; Department of Primary Industries and Fisheries; Department of Natural Resources and Water), the University of Queensland (Faculty of Biological and Chemical Sciences, Centre for Microscopy and Microanalysis, Centre for Marine Studies), the Port of Brisbane, Brisbane City Council and Consolidated Rutile Limited. This is the first workshop where such a large group of experienced marine scientists have collaborated on research projects to generate new data on the species and ecology of Moreton Bay. For 18 days, nearly 40 marine biologists from the United Kingdom, Germany, Singapore, Taiwan, United States of America, New Zealand and Australia worked together to collect field data. This involved intertidal hand collecting, snorkelling and SCUBA diving, and dredging and grab-sampling using the DPI&F Research Vessel, the Tom Marshall. Collections were analysed and sorted in the laboratory, and data and specimens were subsequently further studied at home institutions.

The Moreton Bay Workshop followed in the footsteps of marine biological workshops in Western Australia (Albany, 1988; Rottnest Island, 1991, 1996; Houtman Abrolhos Islands, 1994; Dampier, 2000; Esperance, 2002), and the Northern Territory (Darwin, 1993). All have been part of an international series initiated by Prof. Brian Morton at the University of Hong Kong, with other successful workshops having been held in Hong Kong, the Portuguese Azores and California. It was established to allow international and interstate scientists the opportunity to work with local scientists to generate new scientific information about this important southeast Queensland marine environment. As well, it was a marvellous opportunity for students to meet and work with leading scientists from many fields of marine research. Each scientist paid their own transport costs to Brisbane, and a participation fee that went towards basic accommodation and living expenses. The money raised from sponsorship met all additional expenses including boat and equipment hire, SCUBA diving costs and chemicals, tubes, bottles, and other expendables.

These workshops have proven to be a very successful model for generating an extraordinary amount of new data in a very short space of time, and as they are subsidised by the scientists themselves, are extremely cost effective. It is to be hoped that more such workshops can be organised at other localities along the Queensland coast in the years to come, and they will garner the full financial support from government and industry that they deserve.

Peter J.F. Davie & Julie A. Phillips

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A workshop of such size and duration demands a high degree of cooperation and goodwill from a large number of people and organisations. We are very pleased to acnowledge and thank Margaret Iselin, President of the Minjerribah Moorgumpin, Elders-in-Council, Aboriginal Corporation, for representing the traditional owners of the land, and welcoming us to North Stradbroke Island, and also Darren Burns and other members of the Quandamooka Land and Sea Council for giving us their approval and support. The Directors of the Moreton Bay Research Station, Kevin and Kathy Townsend, and all their staff, were unstintingly helpful in the face of all our demands, and kept the wheels turning smoothly. The staff of the Moreton Bay Marine Park, and in particular Nicola Udy and Carly Bansemer, are thanked for their assistance with permitting and their overall support of the workshop. Similarly, the Director and Marine biodiversity staff of the Queensland Museum enthusiastically embraced the idea of the workshop and contributed greatly by providing Peter Davie's time and salary during the long months of organisation and editing, and through provision of preservatives, collecting equipment, and collection curation. In the field the skipper and crew of the QDPI&F Research Vessel, the *Tom Marshall*, must be singled out for their cheerful and capable help with dredging and grab-sampling, despite large quantities of mud over the back deck. Mr Chad Buxton, of the University of Queensland, and Dr Jo Carini, Queensland Museum volunteered their time and energy during the Workshop as field assistants, and their efforts were greatly appreciated by the organisers and participants.

We could not have undertaken the workshop, nor published the Proceedings, if not for the generous sponsorship of a number of organisations. We were enormously encouraged by the early interest and support of Damien McGreevy and Leonard Costantini of the Queensland Government's Department of the Premier and Cabinet. Similarly, Louise Morland of the Department of Primary Industries and Fisheries, and Chris Robson and Helen Sykes of the Department of Natural Resources and Water, facilitated the significant financial backing provided by those departments. The University of Queensland through the Faculty of Biological and Chemical Sciences, the Centre for Microscopy and Microanalysis, and the Centre for Marine Studies, was also a major sponsor, and we are particularly grateful to Professors Mick McManus, John Drennan, and Ove Hoegh-Guldberg for their confidence in the success of the workshop. Dr Rick Morton and Ms Nikki Wood of the Port of Brisbane Corporation, also threw their weight behind the concept, and we are very pleased to acknowledge the generous financial help from the Port of Brisbane. We are also pleased to thank the Brisbane City Council and Consolidated Rutile Limited for also unquestioningly getting behind us financially. Finally, AMSA National gave early support through a donation to pay for the participation of two postgraduate students. We could not have succeeded without you all, and we sincerely hope that the result justifies your confidence in the project.

Finally, we would like to thank sincerely all the participants in the Workshop. The time spent together was marked by not only everyones hard work, but also by a wonderful sense of camaraderie and the shared joy of discovery that makes being a biologist so exciting. Thank you one and all.

The scleractinian corals of Moreton Bay, eastern Australia: high latitude, marginal assemblages with increasing species richness

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ABSTRACT

Moreton Bay, located 27°S on the east coast of Australia, provides a rare instance of urban, subtropical, marginal coral reefs in an urbanised environment, adjacent to a major city 500 km south of the Great Barrier Reef. These reefs have been regarded as being close to environmental extinction, yet substantial living coral assemblages remain, and are currently at their highest recorded living diversity in this location. We taxonomically review collections of living and fossil coral specimens made over an 83-year period (1924–2007) from this bay. Our study records 64 scleractinian species from 26 genera and 13 families living in Inner Moreton Bay during the period 2003–2007, including 59 reef-building and five solitary species. This includes species newly recruiting into the bay, although our study also reveals the presence of previously unrecorded species in earlier collections. More diverse coral assemblages at this latitude occur in the oceanic waters of Outer Moreton Bay at Flinders Reef and other small reefs, where 125 species from 35 genera are recorded. In total, 143 species from 40 genera are recorded in the Moreton Bay region. The corals of Inner Moreton Bay show a remarkable persistence through time (78% are also recorded in the Holocene fossil record) and space (72% occur in Outer Moreton Bay and 59% to the south in New South Wales), which indicates an inbuilt resilience within regional subtropical assemblages. We suggest that this persistence is the result of a naturally dynamic system, in which intermittent loss of species due to severe natural impacts such as episodic freshwater flooding is mitigated by recruitment from sources outside the bay. We further suggest it is possible for additional regional species to establish themselves in the bay, as changes in the environmental management regime begin to reverse the effects of anthropogenic disturbances such as coral mining, over-fishing, and runoff of nutrients and pollutants. Other factors that may have led to the present high level of species richness could include: the passage of several years of severe drought without major flooding; warmer climatic conditions; or a combination of some or all of these conditions. We present systematic descriptions of all taxa from Inner Moreton Bay, using morphological features specific to Moreton Bay representatives, and also the general distribution and southerly limit for each species, as a baseline for observation of future change. ❐ *Marginal coral reefs, resilience, climate change, biogeography, taxonomy, Moreton Bay, Queensland, Cnidaria, Anthozoa, Hexacorallia, Scleractinia.*

CONTENTS

INTRODUCTION

Moreton Bay constitutes one of the major locations of 'marginal' coral reefs, defined as regions where long-term environmental limitations are reflected by the state of coral reefs or communities (Guinotte *et al.* 2003; Perry & Larcombe 2003). At 27°00′–27°45′ south (Fig. 1) and adjacent to Brisbane, one of Australia's major eastern cities (Skinner *et al.* 1998), this bay is influenced by outflows from several river estuaries, whose occasional intense flooding may significantly reduce its salinity and enhance terrigenous sedimentation (Lovell 1989; Davies & Eyre 1998; Moss 1998; Neil 1998; Lang *et al.* 1998; Lockhart *et al.* 1998). There are many other influences, both anthropogenic and natural, which intermittently or chronically impact on the conditions optimal to coral growth and survival (Harrison *et al.* 1991, 1998; Johnson & Neil 1998a, b; Neil 1998; Fellegara & Harrison 2008). Moreton Bay has been the location of shallow-water coral assemblages through the Holocene (10,000–6,000 ya to present), with living coral now growing as a veneer on unconsolidated Holocene carbonate deposits. Large tracts of these fossil deposits remain intact and are exposed at low tide (Fig. 2; Wells 1955; Neil 1998; McEwan 1998; Moss 1998). Additionally, a site on the seaward side of North Stradbroke Island has yielded a much earlier record of a Pleistocene (135,000 ya) assemblage (Pickett *et al.* 1985, 1989).

The broader Moreton Bay region, as used in this paper, includes two components: 'Inner Moreton Bay', the body of water partly enclosed by North and South Stradbroke, Moreton, and Bribie Islands; and 'Outer Moreton Bay', the rocky reefs immediately outside these large islands, including Flinders Reef near Moreton Island and Flat Rock, Shark Gutter and Shag Rock off the north-east corner of North Stradbroke Island (Fig. 1). Scleractinian corals occur in both components. This review focuses on the taxonomy and species composition of Inner Moreton Bay scleractinian corals, and reviews these in relation to the coral species composition of Outer Moreton Bay as well as

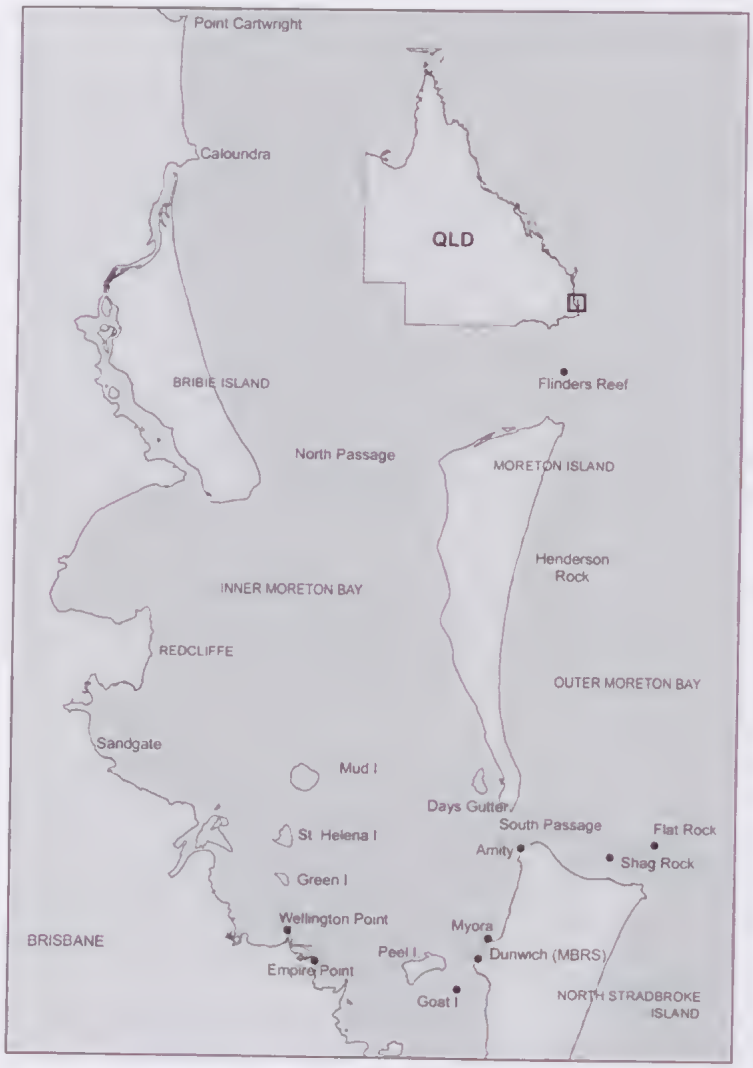

FIG. 1. Map of Moreton Bay region showing main collecting sites of coral specimens mentioned in text.

fossil coral specimens from the Holocene death assemblages found in the inner Bay. The study concentrates on the species that were present in the inner bay in 2003–2007 and all previous specimen-based records of species living in the bay.

Moreton Bay reefs have been considered to be 'as close to ecological extinction ... as the severely degraded reefs of eastern Panama and the Virgin Islands' in respect of seven ecological guilds, including corals (Pandolfi *et al.* 2003). Throughout the late nineteenth and twentieth centuries, Moreton Bay corals were subjected to limestone extraction, firstly by hand and then by dredging (Saville-Kent 1893; Allingham & Neil 1995; Johnson & Neil 1998a). Saville-Kent wrote that the early settlers of the colony of Queensland collected living and dead corals 'in barge-loads', and notes 'By these means, beyond doubt, the original abundant growth of coral in this special area has been materially diminished' (Saville-Kent 1893: 96). Limestone extraction was directed towards fossil reef tracts, but as has been shown, this practice still impacted on living corals directly by accidental extraction, and indirectly by impacting on bottom structure and water quality (Harrison *et al.* 1991). The discovery of diverse coral assemblages within mining leases (Harrison *et al.* 1991), along with declining water quality in the bay during the late twentieth century, and establishment of the Moreton Bay Marine Park in 1993 (zoned in 1996), all contributed to the cessation of fossil reef mining and to measures aimed at improving water quality throughout the bay (Allingham & Neil 1995; Pressland *et al.* 1998).

In contrast to corals living in Inner Moreton Bay, those on reefs of Outer Moreton Bay are exposed to more oceanic waters and are less subject to coastal influences. This area has a far greater coral species diversity. The major reef area, Flinders Reef at 27°00′S, has 119 recorded species (Veron 1986; Harrison *et al.* 1998) in contrast to 44–45 species recorded from inner Moreton Bay up to the year 2000

(Harrison *et al.* 1991, 1998; Harrison & Veron 1993; plus ahermatypic species from Wells 1964).

Moreton Bay coral species have been recorded since Saville-Kent's (1893) classic reports on the marine biota of Queensland. The main published reports on coral species composition have been those of Wells (1955), Lovell (1989), Harrison *et al.* (1991, 1998) and Veron & Harrison (unpublished report 1993). Corals from the Moreton Bay region have also been reported in broader taxonomic works (Veron & Pichon 1976, 1980, 1982; Veron *et al.* 1977; Veron & Wallace 1984). Other studies have examined aspects of life history, including a study of extension rates and environmental records in coral skeletons, which demonstrated that some *Psammocora superficialis* colonies living in Moreton Bay predated the European settlement of Queensland (Roberts & Harriott 2003); and reproductive studies that indicated that many coral species occurring in the bay are reproductive in the late spring-early summer months (Harrison 1993; Harrison *et al.* 1998; Fellegara & Harrison 2008). During the 20th century scientists might have given more attention to the corals of Moreton Bay had they not had the lure of the Great Barrier Reef nearby to the north. Recent focus on the potential impacts of global climate change on coral reefs (e.g. Kleypas *et al.* 2001; Lough 2008), the nature and vulnerability of marginal reefs (Guinnotte *et al.* 2003), and the potential for latitudinal range extensions in Queensland's tropical organisms (Harriott & Banks 2002; Lough 2008) has changed this situation somewhat, and a body of information is building about Moreton Bay coral assemblages into the 21st century (Fellegara & Harrison 2008).

When studies are accompanied by museum-deposited specimens, such material can be reviewed and used to interpret previous reports in the light of current taxonomy. Five specimens in the Natural History Museum, London, collected by Saville-Kent in 1889 appear to be the first specimens so deposited. The Queensland Museum's collections of Moreton Bay corals began with specimens collected in 1924 by Charles Hedley, a malacologist who, after a career with the Australian Museum, became Scientific Officer for the Great Barrier Reef Committee (now Australian Coral Reef Society) (Mather 1986: 192–193). Some specimens from the research of Wells (1955), Lovell (1985, 1989), Harrison *et al.* (1991, 1998), Harrison & Veron (1993), Fellegara (2008a) and Fellegara & Harrison (2008) are deposited in Queensland Museum/ Museum of Tropical Queensland. This study taxonomically appraises all these collections, and reassesses the living corals of Moreton Bay over the period 2003–2007, including the study conducted during the Thirteenth International Marine Biological Workshop of February 2005 (Davie & Phillips 2008).

The family-level classification of Scleractinia is in some turmoil at present following findings from molecular genetic analyses that indicate paraphyly in many families (Fukami *et al.* 2004, 2008). These findings will necessitate changes to generic and family classifications that will impact particularly on the Faviidae, the dominant family of corals in Moreton Bay, and Mussidae, also a major family in the bay. Following a monographic revision by Budd *et al.* (in press), Pacific members of each of these families will be allocated a new family (Budd, pers. comm.). Most important for Moreton Bay corals will be a name change for the genus *Favia*, which dominates by its abundance and persistence through time (Lovell 1989; Harrison *et al.* 1991; Johnson & Neil 1998b; this paper).

This present paper examines the collections of the Queensland Museum in Brisbane and the Museum of Tropical Queensland in Townsville, to provide a complete record of:

1) species living in Moreton Bay in the early 21st century, based on our collections 2003–2007.
2) species records from the 20th century, based on museum specimens collected from 1924 onwards
3) taxonomy and field characteristics of all species.

4) the Holocene fossil record of the species within the bay.

5) distribution records of the species in the broader Moreton Bay region.

6) distributions further south which, together with Moreton Bay records, indicate the present southerly limits for each of the species living in the Moreton Bay region.

MATERIALS AND METHODS

SITES, HABITATS, AND COLLECTING METHODS

The main sites from which specimens were collected are indicated on Fig. 1. Living species were recorded, photographed, and/or collected for this study from the fringing reefs primarily around Peel and Stradbroke Islands (Fig. 2A), Green, Mud and Goat (or Bird-Goat) Islands, and from Empire and Wellington Point. No specimens

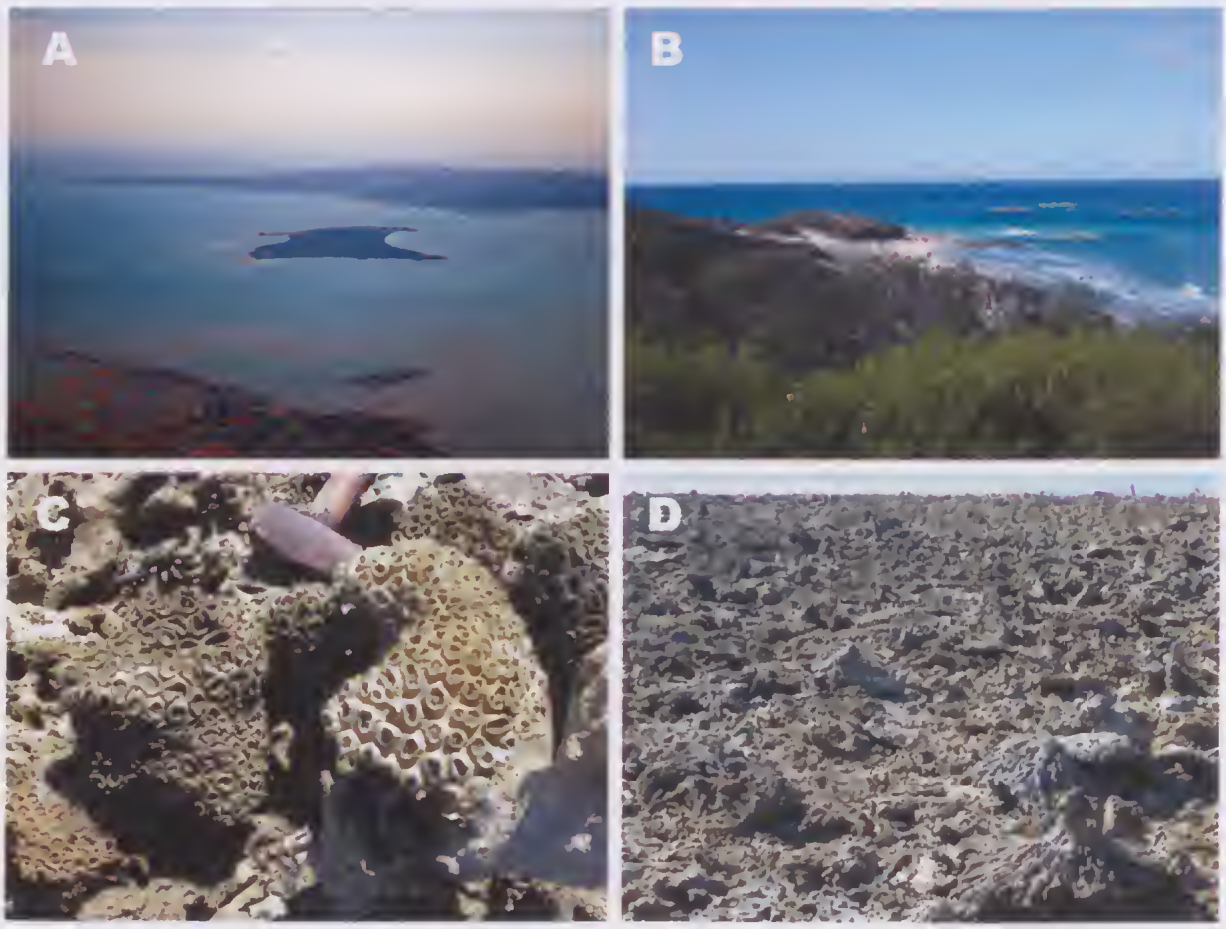

FIG. 2. Examples of Moreton Bay sites. A, Inner Moreton Bay, aerial view of Peel I. (centre) from Cleveland on the mainland with North Stradbroke I. in the background. (Photo: PLH). B, View north from headland near Point Lookout, over the exposed rocky outcrops comprising Manta Ray Bommie, with Flat Rock further out to sea in the centre left. (Photo: CCW). C, Holocene sub-fossil assemblage dominated by species of Faviidae, Empire Point (Photo: CCW). D, Holocene sub-fossil assemblage dominated by Acropora, Mud I. (Photo: CCW).

TABLE 1. Records of families, genera and species occurring in Inner Moreton Bay from this study, compared with records from: Outer Moreton Bay (Flinders Reef, Shag and Flat Rock); south of Moreton Bay; and fossil assemblages in Inner Moreton Bay. x = represented by specimen/s in the collections of the Queensland Museum/Museum of Tropical Queensland); v = recorded in Veron (1993); h = from tables in Harriott *et al.* (1994, 1999); p = photographed in this study (most species were photographed, but only those photographic records adding to the species list are indicated). w&f = observed by C. Wallace and I. Fellegara in 2005.

Family	Genus	Species	Inner MB	Outer MB	South of MB	Fossil MB
Pocilloporidae	*Pocillopora*	*damicornis*	x	v	h	x
		verrucosa		p		
	Seriatopora	*hystrix*		v		
	Stylophora	*pistillata*		v	h	
Acroporidae	*Acropora*	*abrotanoides*		x, v	x, h	
		aculeus		x		
		anthocercis			x, h	
		austera		x, v	x	
		cerealis		x	h	
		chesterfieldensis			h	
		clathrata		v	x, h	
		cytherea		x, v	h	
		dendrum			h	
		digitifera	x	w & f	x, h	x
		divaricata	x	x, v	x	x
		donei	x	x, v		
		florida		x, v	x, h	
		gemmifera		x, v		
		glauca	x	x, v	x, h	x
		grandis		x, v		
		granulosa			h	
		humilis		x, v	x, h	
		hyacinthus	x	x, v	x, h	x
		intermedia		x, v		
		latistella	x	x, v	x, h	
		listeri			h	
		loripes		x	x, h	
		lovelli			x	
		lutkeni	x	x	x, h	x
		microclados		x, v		
		millepora		x, v	h	
		muricata			h	
		nana		x, v		

TABLE 1. continued ...

Family	Genus	Species	Inner MB	Outer MB	South of MB	Fossil MB
Acroporidae	*Acropora*	*nasuta*	x	x, v	h	
		palmerae		x, v	x, h	
		polystoma		x	h	
		pulchra			x, h	x
		robusta		x, v	x, h	
		samoensis	x	v		x
		sarmentosa		x, v	x, h	
		secale		x, v	x	
		solitaryensis	x	x, v	x, h	x
		subulata		x, v		
		valida	x	x, v	x, h	x
		verweyi	x	x, v	h	
		willisae			h	
		yongei		x,v	h	
	Astreopora	*cucullata*		v		
		listeri	x	v		x
		moretonensis		v		x
		myriophthalma		v		
	Isopora	*crateriformis*		x		
		cuneata		x		
		palifera		x, v		
	Montipora	*angulata*			h	
		caliculata		x, v		
		danae		x, v	h	
		efflorescens			h	
		foliosa		x, v		
		foveolata		v		
		mollis		x, v	h	
		monasteriata		v		
		peltiformis		x, v		
		spongodes		x, v	h	
		spumosa		x, v	h	
		tuberculosa		v		
		turgescens			h	
		turtlensis		v	h	
		venosa		x, v	h	

TABLE 1. continued ...

Family	Genus	Species	Inner MB	Outer MB	South of MB	Fossil MB
Poritidae	*Alveopora*	*altingi*		v		
		marionensis		v		
		spongiosa		v		
Poritidae	*Goniopora*	*djiboutiensis*	x	v	h	x
		lobata	x	v	h	x
		minor	x			x
		norfolkensis			h	
		somaliensis		v		
		stokesi	x		h	x
		stutchburyi	x	v		x
		tenuidens	x			
	Porites	*australiensis*		v		
		heronensis			h	
		lichen			h	
		lobata		v	h	
		lutea		v		
		murrayensis		v		
Siderastreidae	*Coscinaraea*	*columna*		v	h	
		mcneilli			h	
	Psammocora	*albopicta*	x		Benzoni 2006	
		contigua	x	v	h	
		haimeana		v	h	
		profundacella	x		x	
		superficialis	x	v	h	x
Agaricidae	*Leptoseris*	*explanulata*		p		
		hawaiiensis			h	
	Pavona	*decussata*			h	
		duerdeni		x		
		explanulata		v	h	
		maldivensis		p, v		
		minuta		v	h	
		varians		v	h	
		venosa			h	
Fungiidae	*Cycloseris*	*costulata*		v	h	
		curvata			h	
		cyclolites	x			
Pectinidae	*Echinophyllia*	*aspera*	x	v	h	x
	Mycedium	*elephantotus*		v	h	

TABLE 1. continued ...

Family	Genus	Species	Inner MB	Outer MB	South of MB	Fossil MB
Merulinidae	*Hydnophora*	*exesa*	x	x	h	x
		microconus			h	
		pilosa			h	
Merulinidae	*Scolymia*	*australis*		v	h	
		vitiensis		v		
Faviidae	*Barabattoia*	*amicorum*	x			
	Cyphastrea	*microphthalma*				x
		serailia	x	v	h	x
		chalcidium			h	
	Favia	*favus*	x	v	h	x
		maritima	x	v		x
		matthai	x			x
		pallida	x	v		x
		rotumana	x			x
		speciosa	x	v	h	x
		stelligera			h	
		veroni	x			x
	Favites	*abdita*	x	v	h	x
		chinensis	x	x, v	h	
		flexuosa	x	x, v	h	
		halicora	x		h	x
		pentagona		v		
		russelli		v	h	
	Goniastrea	*aspera*	x	x		x
		australensis	x	x, v	h	x
		favulus		v	h	
		palauensis	x		h	x
		pectinata	x	v	h	
	Leptastrea	*bewickensis*		v		
		transversa		v	h	
	Leptoria	*phrygia*		v		
	Montastrea	*annuligera*		v		
		curta	x	v	h	x
		magnistellata		v	h	
	Platygyra	*daedalea*		v	h	
		lamellina	x	v	h	x
		sinensis		v		
	Plesiastrea	*versipora*	x	v	h	x

TABLE 1. continued ...

Family	Genus	Species	Inner MB	Outer MB	South of MB	Fossil MB
Mussidae	*Acanthastrea*	*bowerbanki*	x	v	h	x
		echinata	x	v	h	x
		hemprichii	x			x
		hillae	x	x, v	x, h	x
		lordhowensis	x	v	h	x
	Blastomussa	*wellsi*	x		x, h	x
	Lobophyllia	*corymbosa*	x	v		x
		hemprichii		v		
	Micromussa	*amakusensis*	x	x		x
	Oulophyllia	*crispa*	x	x		x
	Symphyllia	*radians*			h	
Turbinoliidae	*Conocyathus*	*zealandiae*	x		Cairns 2004	
Dendrophylliidae	*Heteropsammia*	*cochlea*		v	h	
		moretonensis	x			x
	Turbinaria	*bifrons*		v		
		frondens	x	v	h	x
		mesenterina		v	h	x
		patula	x	v	h	
		peltata	x	v	x, h	x
		radicalis	x	v	x, h	
		stellulata		v		
Euphyllidae	*Euphyllia*	*ancora*		v		
Caryophylliidae	*Heterocyathus*	*aequicostatus*	x			
Flabellidae	*Flabellum*	*knoxi*	x			
Astrocoeniidae	*Stylocoeniella*	*guentheri*			h	
Total Species			64	125	107	50
Total Genera			26	35	30	21
Combined Moreton Bay			143	40		

were collected in the marine protection zone of Peel I., but colonies were recorded and photographed there. Fossil specimens were recorded and collected at Mud I. (Fig. 2D) and Empire Point (Fig. 2C). Comparative records were made, and some specimens collected, at Flat Rock and Shag Rock (Fig. 2B) immediately outside northern North Stradbroke Island. Records and photographs were taken at Flinders Reef, a marine protected area.

These habitats have been described in Harrison *et al.* (1991, 1998), Johnson & Neil (1998), Neil (1998), and Fellegara & Harrison (2008). All inner Moreton Bay sites have fringing reefs. At Myora, corals co-occur with seagrass beds, and at Amity, corals occur scattered in very disturbed conditions on, and in front of, a rock wall (Fellegara 2008b). Sites at Amity, Myora, and along the NW shore of Stradbroke Island, have the clearest water, due to oceanic waters entering the bay through South Passage. In contrast, Mud Island has the greatest sediment load. Green, Peel and Goat Islands have similar winter sediment loads, but Green Island, the closest of these islands

to the mainland, has heavier sedimentation during summer months (Johnson & Neil 1998). Empire and Wellington Points, while having some fringing reef development, also provide the main source of Holocene fossil material *in situ*. (This material is currently regarded as being 6,000 ya or less (Neil 1998) and while this is generally regarded as 'sub-fossil', the term fossil is used in this monograph to encompass specimens from these and earlier sites).

Some 25 dives were made by the authors, separately or together, to record and collect living species over the period 2003–2007, 18 in Inner Moreton Bay and 7 in Outer Moreton Bay. Sites with Holocene fossil corals (Empire Point and Mud Island) were each sampled three times, and were accessed by walking at low tide.

TAXONOMIC INFORMATION

Material examined. Primary reference material included extant corals and subfossil specimens (herein recorded as fossil), housed at the Queensland Museum's campuses in Brisbane (QM) and Townsville (Museum of Tropical Queensland or MTQ), including type specimens. New material presented in this paper includes living and fossil specimens collected by: P.L. Harrison (PLH) 1991– 2005; I. Fellegara (IF) 2002– 2005 and C.C. Wallace and P.R. Muir (CCW; PRM) 2003–2007, also J. Hsieu and other members of the Moreton Bay Thirteenth International Marine Biological Workshop (2005) and H. Fukami (2007). Specimens collected prior to this include living corals collected in 1924 by C. Hedley for the Great Barrier Reef Committee (now Australian Coral Reef Society) and in 1938 by members of the Queensland University Science Students' Club; material documented by Wells (1955), Lovell (1975a, 1989) and individual specimens collected incidentally by museum or university staff. Some Quaternary fossils from Pickett *et al.* (1985, 1989) are included also, as well as fossil specimens with only 'Moreton Bay' as provenance, which are believed to have come to QM from University of Queensland Geology Department. Collections from Outer Moreton Bay and New South Wales include specimens referenced in Veron & Pichon (1982), Veron & Wallace (1984), Harrison *et al.* (1991, 1998), Harrison & Veron (1993) and Harriott *et al.* (1994, 1995, 1999). Wherever possible, type specimens from other museums were examined, as noted in 'Material Examined'. Some type material was photographed on our behalf by F. Benzoni and M. Pichon. Specimens of species living in Outer Moreton Bay and south of Moreton Bay, as well as additional species represented in the fossil record of Moreton Bay, were used in conjunction with published species records to develop tables in the paper, but are not mentioned individually.

Museums from which type material was examined, in addition to QM and MTQ are: National Museum of Natural History (Smithsonian Institution), Washington DC, USA (USNM); Natural History Museum, London, UK (NHML); Museum für Naturkunde der Humboldt Universität, Berlin, Germany (MNB); and Museo di Storia Naturale di Milano, Italy (MSNM). Additional type material was borrowed for species previously identified for Moreton Bay (e.g. *Goniopora columna*, *G. soualiensis*) but this is not mentioned in the text as the identification was not validated.

Synonymies. Primary synonyms only are listed. Synonymies follow the most recent revisionary works. Additional taxonomic and distributional references as well as literature describing life-history, ecology and distribution are cited in 'other references' for each species.

Descriptions of species. These are based on examination of Moreton Bay material, comparison with type material wherever this was necessary, and comparison with specimens from collections listed above. For descriptions of material, measurements were taken from at least five specimens from Moreton Bay per species, wherever possible. For features such as corallite measurements and septal counts, five corallites per specimen were measured. Corallite depths were measured using a probe inserted into the centre of the corallite. Corallite calice diameters were measured to the centre of the wall, along the longest diameter. Measurements such as corallite diameter and septal counts were taken from non-dividing corallites.

The descriptions of characteristics are kept brief, and these supplement the descriptions of families and genera. Further information on skeletal characteristics of the species can be obtained from the literature associated with the species.

Distribution records. Distributions given are based on QM and MTQ collection localities, and on the literature, with Veron (1993, 2000), Hoeksema (1989), Wallace (1999), and Cairns (2004) being primary sources. East Australian distribution limits have also been refined with the help of recent literature records, especially Harriott *et al.* (1994, 1995, 1999), and the present results. These records include islands and reefs immediately offshore from the Australian coastline, but not Coral Sea reefs. For each species, the most southerly of these records is included, so that a baseline exists to gauge any future range extension.

RESULTS AND DISCUSSION

Our study found 64 scleractinian species from 26 genera and 13 families living in Inner Moreton Bay during the period 2003–2007 (Table 1), and these are reported in the systematic accounts that follow. Of these, 59 species are colonial reef-building corals, and five are solitary sea floor species. From a non-exhaustive study of the fossil assemblages of Inner Moreton Bay, 50 of the living species (78%) have been matched to fossil records within the collections, and a further four fossil species are newly recorded. making 52 species from 21 genera recorded in the fossil record, but this number will probably grow as those deposits are further studied.

The Inner Moreton Bay coral species composition contrasts with 125 species from 35 genera and 12 families in Outer Moreton Bay (present study; Harrison *et al.* 1998; Veron 1993) (Table 1). In total, 143 scleractinian species from 40 genera and 15 families were recorded from the entire Moreton Bay region. This compares with 107 species from 30 genera recorded south of Moreton Bay in New South Wales (Table 1).

The collections indicate that the coral species diversity of Moreton Bay is currently higher than ever previously reported, but that the record has not always been documented accurately. Specimens from previous workers (Hedley collecting in 1924; Wells 1955; Lovell 1985, 1989), further documented in the systematic arrangement below, along with the Holocene fossil record, indicate that many species were continuously or intermittently present in the bay, but their presence went unnoticed. For example, the oldest Queensland Museum collections were made by Charles Hedley for the Great Barrier Reef Committee in 1924, and include two specimens of *Acanthastrea lordhowensis*, not described until 1982. Also species in some genera, e.g. *Favia* and *Psammocora*, have been variously lumped in visual surveys.

Based on numbers of species and genera, Faviidae is the dominant coral family, with 21 species in 9 genera. This is followed by Mussidae with 8 species in 4 genera, Acroporidae with 13 species in 2 genera, and Dendrophylliidae with 5 species in 2 genera. Examples of the living appearance of some of the representatives of these and other species living in the bay are illustrated in Plates 1–6 and further described in the systematic section below. The two Holocene assemblages studied in the bay, at Empire Point and Mud Island, visually appear to be dominated by Faviidae and *Acropora* respectively (see Fig. 2C, D). In terms of species composition Faviidae and especially the genus *Favia*, also dominate coral assemblages in most parts of the bay, except for Myora on North Stradbroke Island which is dominated by *Acropora* (Harrison *et al.* 1998; Fellegara 2008a; Fellegara & Harrison 2008). Species richness and other characteristics of the sites are discussed in Harrison *et al.* 1991 and Fellegara & Harrison (2008). Some of the specimens described in this paper came from in and around the artificial substrate of the Amity rock wall, North Stradbroke Island, which during 2003–2007 was dominated by *Pocillopora damicornis*, which was

TABLE 2. Moreton Bay coral species – distribution types in relation to Inner Moreton Bay, Outer Moreton Bay, New South Wales and the fossil record in Inner Moreton Bay. Species in the 'broadly persistent' category are mostly abundant species, except for those marked: * intermittently present; **rare, + solitary sea-floor corals (? for *Psammocora* indicates that visual-only records may have lumped some species). Other symbols as for Table 1.

Genus	Species	Inner MB	Outer MB	South of MB	Fossil MB
Broadly Persistent					
Pocillopora	*damicornis*	x	v	h	x
Acropora	*digitifera*	x	w & f	x, h	x
	divaricata	x	x, v	x	x
	glauca	x	x, v	x, h	x
	hyacinthus	x	x, v	x, h	x
	lutkeni	x	x	x, h	x
	solitaryensis	x	x, v	x, h	x
	valida	x	x, v	x, h	x
Goniopora	*djiboutiensis*	x	v	h	x
	lobata	x	v	h	x
Psammocora	*superficialis*	x	v	h	x
Echinophyllia	*aspera*	x	v	h	x
Hydnophora	*exesa*	x	x	h	x
Cyphastrea	*serailia*	x	v	h	x
Favia	*favus*	x	v	h	x
	speciosa	x	v	h	x
Favites	*abdita*	x	v	h	x
Goniastrea	*australensis*	x	x, v	h	x
Montastrea	*curta*	x	v	h	x
Platygyra	*lamellina*	x	v	h	x
Plesiastrea	*versipora*	x	v	h	x
Acanthastrea	*bowerbanki*	x	v	h	x
	echinata	x	v	h	x
	hillae	x	x, v	x, h	x
	lordhowensis	x	v	h	x
Turbinaria	*frondens*	x	v	h	x
	peltata	x	v	x, h	x
Regionally Persistent					
Acropora	*samoensis*	x	v		x
Astreopora	*listeri*	x	v		x
Goniopora	*stutchburyi*	x	v		x

TABLE 2. continued ...

Genus	Species	Inner MB	Outer MB	South of MB	Fossil MB
Favia	*maritima*	x	v		x
	pallida	x	v		x
Goniastrea	*aspera*	x	x		x
Lobophyllia	*corymbosa*	x	v		x
Micromussa	*amakusensis*	x	x		x
Oulophyllia	*crispa*	x	x		x
Goniopora	*stokesi*	x		h	x
Favites	*halicora*	x		h	x
Goniastrea	*palauensis*	x		h	x
Blastomussa	*wellsi*	x		x, h	x
Acropora	*latistella*	x	x, v	x, h	
	nasuta	x	x, v	h	
	verweyi	x	x, v	h	
Psammocora	*contigua*	x	v	h	
Favites	*chinensis*	x	x, v	h	
	flexuosa	x	x, v	h	
Goniastrea	*pectinata*	x	v	h	
Turbinaria	*patula*	x	v	h	
	radicalis	x	v	x, h	
Acropora	*donei*	x	x, v		
Psammocora	*albopicta*	x			
	profundacella	x		x	
Conocyathus	*zelandi*	x		Cairns 2004	
Restricted to Inner Moreton Bay					
Goniopora	*minor*	x			x
	tenuidens	x			
Cycloseris	*cyclolites*	x			
Barabattoia	*amicorum*	x			
Favia	*matthai*	x			x
	rotumana	x			x
	veroni	x			x
Acanthastrea	*hemprichii*	x			x
Heteropsammia	*moretonensis*	x			x
Heterocyathus	*aequicostatus*	x			
Flabellum	*knoxi*	x			

rare or absent elsewhere in the bay (Wells 1955; Harrison *et al.* 1998; Fellegara 2008b).

Numerous features of the coral colonies in Moreton Bay are characteristic of coral skeletons from fringing reef habitats with high terrigenous input and/or variable living conditions. For example, colonies often show patches of dead skeleton (e.g., see Fig. 6C), regrowth on old skeleton, and eroded undersurface. Some corallite features, especially noticeable in families Faviidae and Mussidae, consistently show variations identified with 'ecomorphs' from turbid habitats (see Veron & Pichon 1974; Veron *et al.* 1976, 1978). It is notable that most species consistently show deeper corallites and diminished paliform lobe formation, compared with the features of those species in open water situations. Additionally, many of the specimens in these families show a high degree of corallite division: some *Favia* colonies growing semi-submerged in silt or mud approach a meandroid condition. Colonies, especially those with massive colony form, may also be exposed to different habitat conditions on different parts of the same specimen. For example, many massive colonies have small, crowded corallites on top (sometimes so crowded as to give a cerioid appearance to plocoid corallites) and a gradation down the sides of the colony, to large, cerioid corallites towards the base. These features are noted in the species descriptions below.

Persistence of taxa in Moreton Bay, based on our results, is examined in Table 2, where Inner Moreton Bay species are grouped into persistence categories, based on the number of distribution patterns in space and time shared by the species.

A 'broadly persistent' group of 27 species includes those that also occur in Outer Moreton Bay, south of Moreton Bay, and in the fossil record of Moreton Bay (Table 2). Members of this group (40% of species, or 44% of reef-building species) belong to broad and long-established subtropical populations of species which are also, in the main, established throughout the Great Barrier Reef. This group includes the numerically dominant and persistent species in the bay (Fellegara & Harrison 2008) as well as some species that are episodically present (e.g. some of the Acroporidae — Lovell 1989; Johnson & Neil 1998b) or recorded as rare in living populations, as indicated in Table 2. These species have existed in the bay, either continuously or intermittently, since Holocene times, and many of them are likely to have breeding populations in the bay, with sexual reproduction occurring, at least when environmental circumstances permit (Harrison 1993; Harrison *et al.* 1998; Fellegara 2008a; Fellegara & Harrison 2008).

A second category, 'regionally persistent', includes Inner Moreton Bay species that occur in two of the three other situations: Outer Moreton Bay, further south, or fossil assemblages as well as those which occur in Outer Moreton Bay but do not have a fossil record in the bay (Table 2). These species also have a persistence which is generally indicative of regionally established populations. The first thirteen species are common within Moreton Bay and they are recorded in the Holocene assemblages of the bay. The remaining species lack a fossil record (this may be an artefact of limited collecting and examination of this record), however many of these species are rare or intermittent within the living asssemblages. The four *Acropora* species that are shared only with Outer Moreton Bay are probably recruiting into the bay as water quality conditions improve (Harrison *et al.* 1998). *Acropora donei*, for example, has been found once at Myora but is the dominant *Acropora* at Shag Rock immediately outside North Stradbroke Island.

The last category, 'restricted to inner bay?', includes species for which the only records in the region come from Inner Moreton Bay, either as living species or additionally in the fossil record (Table 2). In the case of the solitary, sea-

floor dwelling genera (indicated in Table 2), dredged material has not been examined for the other sites, but distribution further south is currently recorded only for *Conocyathus zelandiae* (Cairns 2004). For the reef-building species, all except *Favia veroni* are common in Moreton Bay. The remaining group includes *Barabattoia amicorum*, *Acanthastrea hemprichii*, three species of *Goniopora* and two species of *Favia*. It is suggested that populations of these species are well adapted to the inshore fringing reef conditions within the bay.

These results indicate that Inner Moreton Bay sustains populations of corals that are well adapted to the marginal conditions of a high latitude location, and that, given improved water quality and protection from disturbance, their numbers, in terms of both species diversity and abundance of rare corals, will increase within the bay (Harrison *et al.* 1991). Although species and even families of corals have become rare or extinct in the bay due to major flooding (Lovell 1989; Davies & Eyre 1998; Johnson & Neil 1998b; Fellegara & Harrison 2008), if this impact were to be ameliorated by changes in sediment, nutrient and pollution load of coastal rivers due to new conservation measures, populations of most of the impacted species living immediately outside the bay could potentially provide new recruits to replenish the Inner Bay populations.

Overall, the groupings in Table 2 indicate that the coral populations of Moreton Bay form a dynamically resilient assemblage, whose composition may be waxing and waning depending on conditions and episodic events within the bay. They have to date shown a great resilience in the face of changing environmental conditions, including sea level change and concomitant coastal erosion, intermittent freshwater intrusion due to coastal flooding, marginal conditions for growth and reproduction due to high latitude, and the impact of human interference and exploitation such as coral mining, pollution and overfishing. Much of this resilience may be due to the presence of coral populations at sites immediately outside the bay, as taxon loss due to episodic events may be ameliorated by larval dispersal and recruitment (Harrison & Wallace 1990) from these sites. The presence of populations of a majority of the Moreton Bay coral species south of the Queensland border (Veron 1993; Harriott *et al.* 1994, 1995, 1999) is a further indication that this assemblage is resilient and adaptable to subtropical conditions.

Because Moreton Bay has a major function as a shipping port for Brisbane, it is an example of a 'human-dominated environment' (Nyström *et al.* 2000). An optimistic viewpoint suggests that survival of coral populations can be enhanced by responsible environmental management. This must include resetting conditions as close as possible to optimum for survival of a diverse and healthy, functional reef assemblage (e.g. Nyström *et al.* 2000; McLanahan *et al.* 2002; West & Salm 2003; Adgar *et al.* 2005). Recent remediation efforts to reverse human-induced environmental deterioration in Moreton Bay have included cessation of coral mining, legislation to improve water quality and reduce fishing pressure, and establishment of marine protected areas for Moreton Bay and region. Introduction of these measures has coincided with favourable environmental conditions for coral survival in the region in the early 21st century, including a period of prolonged drought without severe coastal flooding since 1996, and possibly warmer winter temperatures due to sea surface temperature rise (Lough 2008). It appears that this fortunate coincidence of events has led to increases in both diversity and abundance of the coral assemblages of Moreton Bay (Fellegara 2008a, b; Fellegara & Harrison 2008). Even if this situation is challenged by an event such as another large flood, our study indicates that, given ongoing responsible management of the environment, the species composition that we have herein documented, will persist, and the coral assemblages of Moreton Bay are likely to survive into the future.

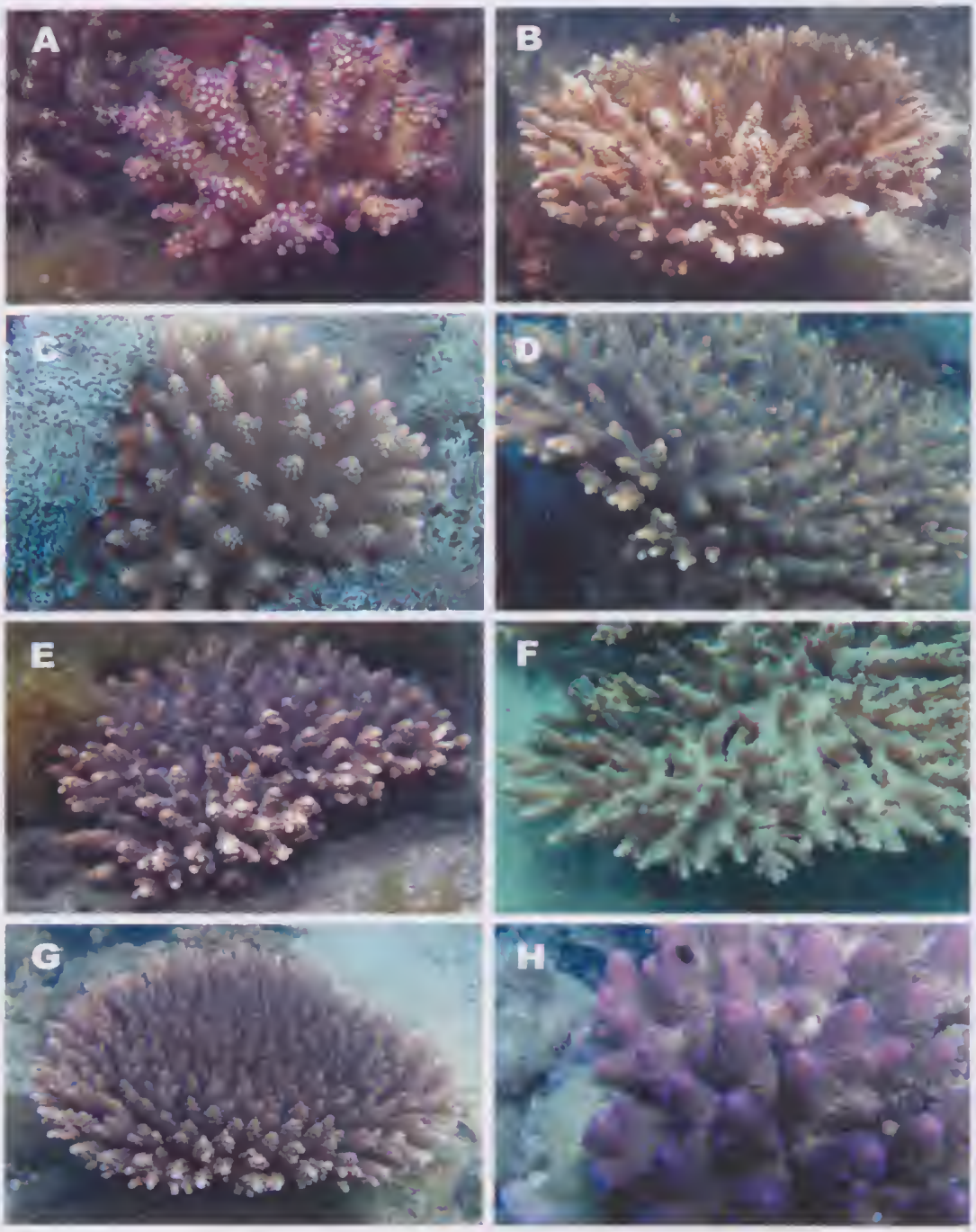

FIG 3. Field appearance of some *Acropora* species in inner Moreton Bay. A, *Acropora valida*; B, *Acropora divaricata*; C, *Acropora nasuta*; D, *Acropora glauca*; E, *Acropora digitifera*; F, *Acropora donei*; G, *Acropora hyacinthus*; H, *Acropora samoensis*. Scale various.

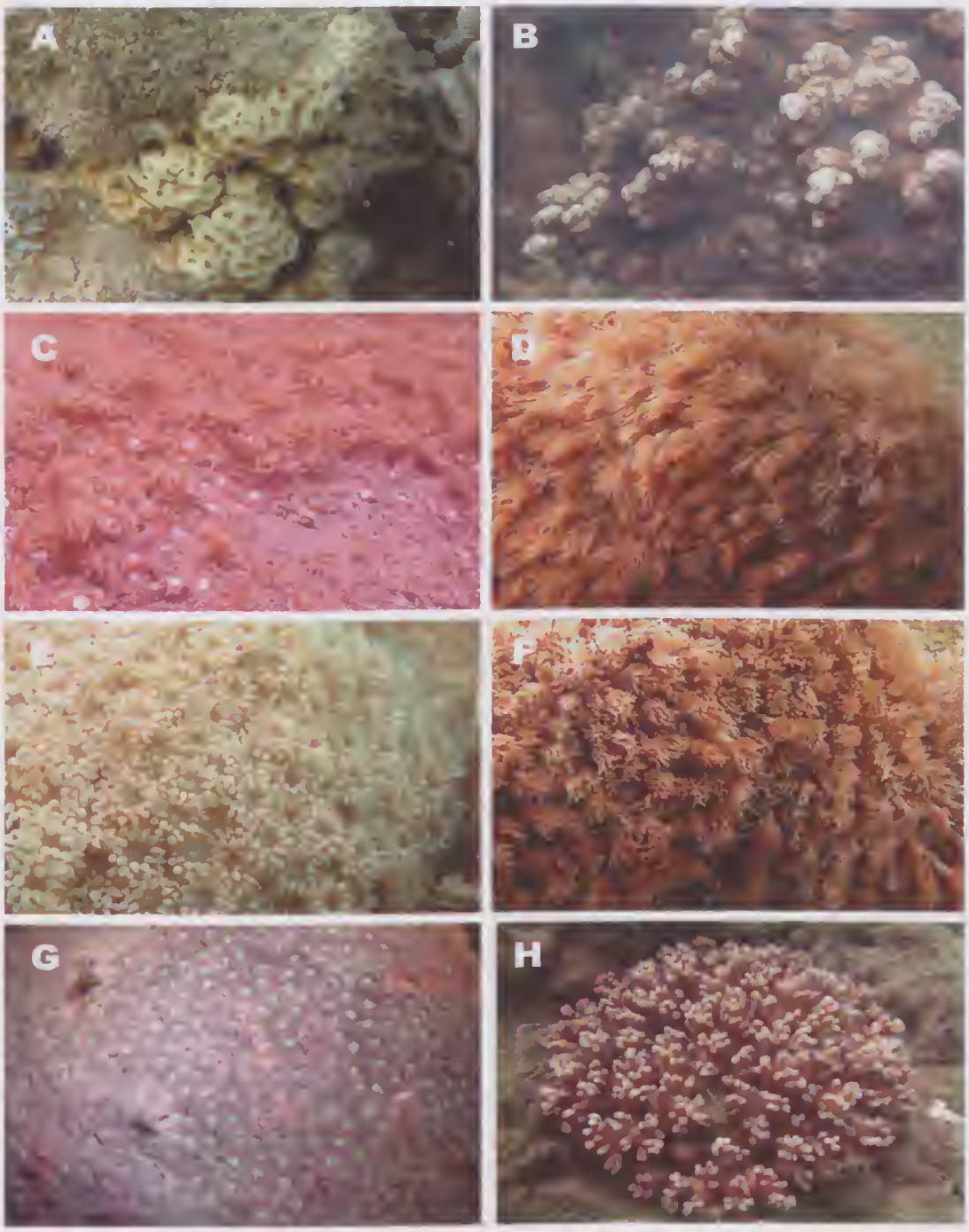

FIG 4. Field appearance of A, *Psammocora superficialis*; B, *Psammocora profundacella*; C, *Goniopora djiboutiensis*; D, *Goniopora lobata*; E, *Goniopora minor*; F, *Goniopora stokesi*; G, *Goniopora stutchburyi*; H, *Pocillopora damicornis*. Scale various.

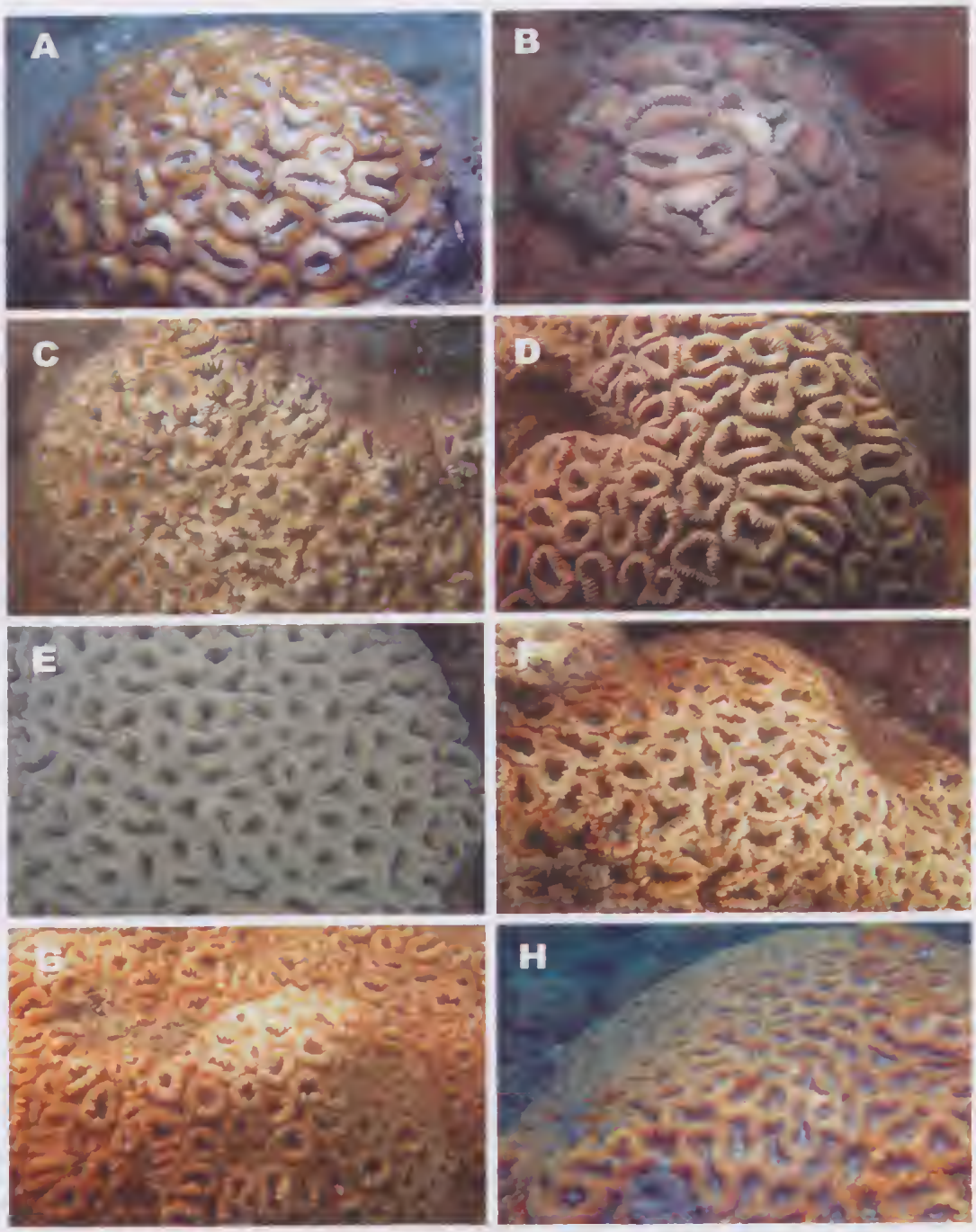

FIG 5. Field appearance of *Favia* and *Favites* species in inner Moreton Bay. A, *Favia favus*; B, *Favia veroni*; C, *Favia rotumana*; D, *Favia maritima*; E, *Favia speciosa*; F, *Favia pallida*; G, *Favia matthai*; H, *Favites halicora*. Scale various.

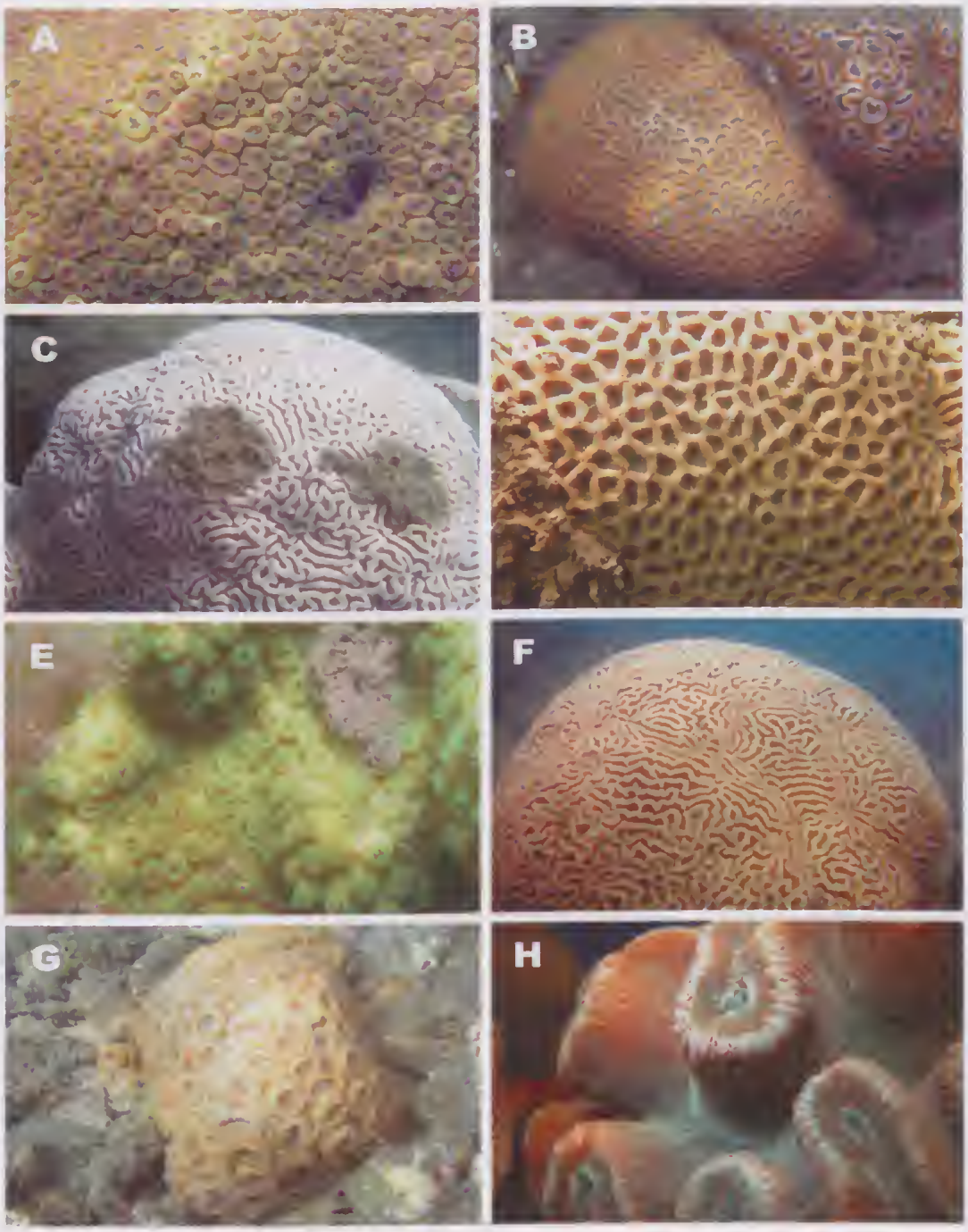

FIG 6. Field appearance of A, *Plesiastrea versipora*; B, *Goniastrea aspera* (centre with *Favia favus* left). C, *Goniastrea australensis*; D, *Goniastrea aspera*; E, *Cyphastrea serailia*; F, *Oulophyllia crispa*; G, *Montastrea curta*; H, *Barabattoia amicorum*. Scale various.

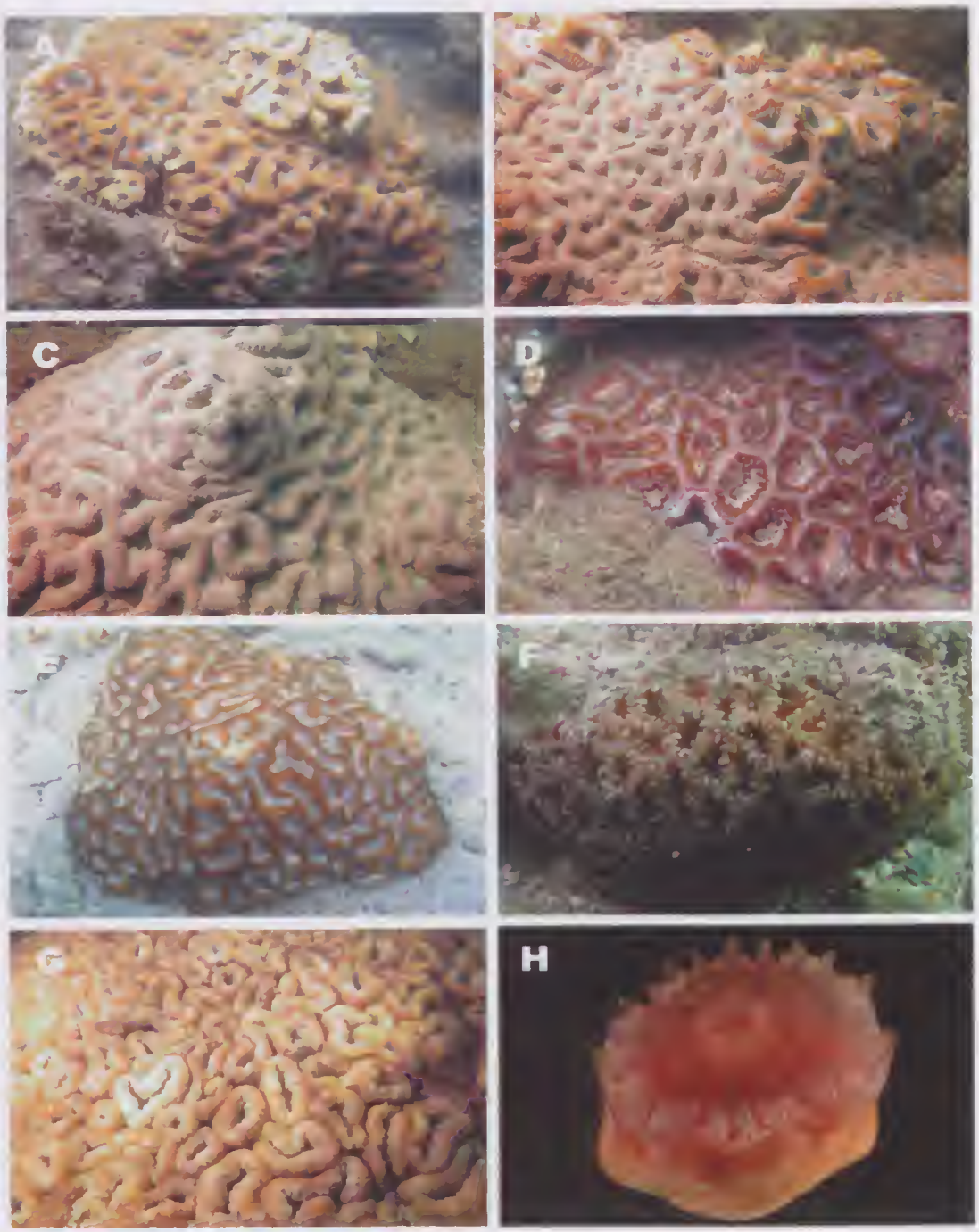

FIG 7. Field appearance of *Acanthastrea* and *Heteropsammia*. A, *Acanthastrea echinata*; B, *Acanthastrea hemprichii*; C, *Acanthastrea bowerbanki*; D, *Acanthastrea lordhowensis*; E, *Acanthastrea hillae*; F, *Micromussa amakusensis*; G, *Lobophyllia corymbosa*; H, *Heteropsammia moretonensis*. Scale various.

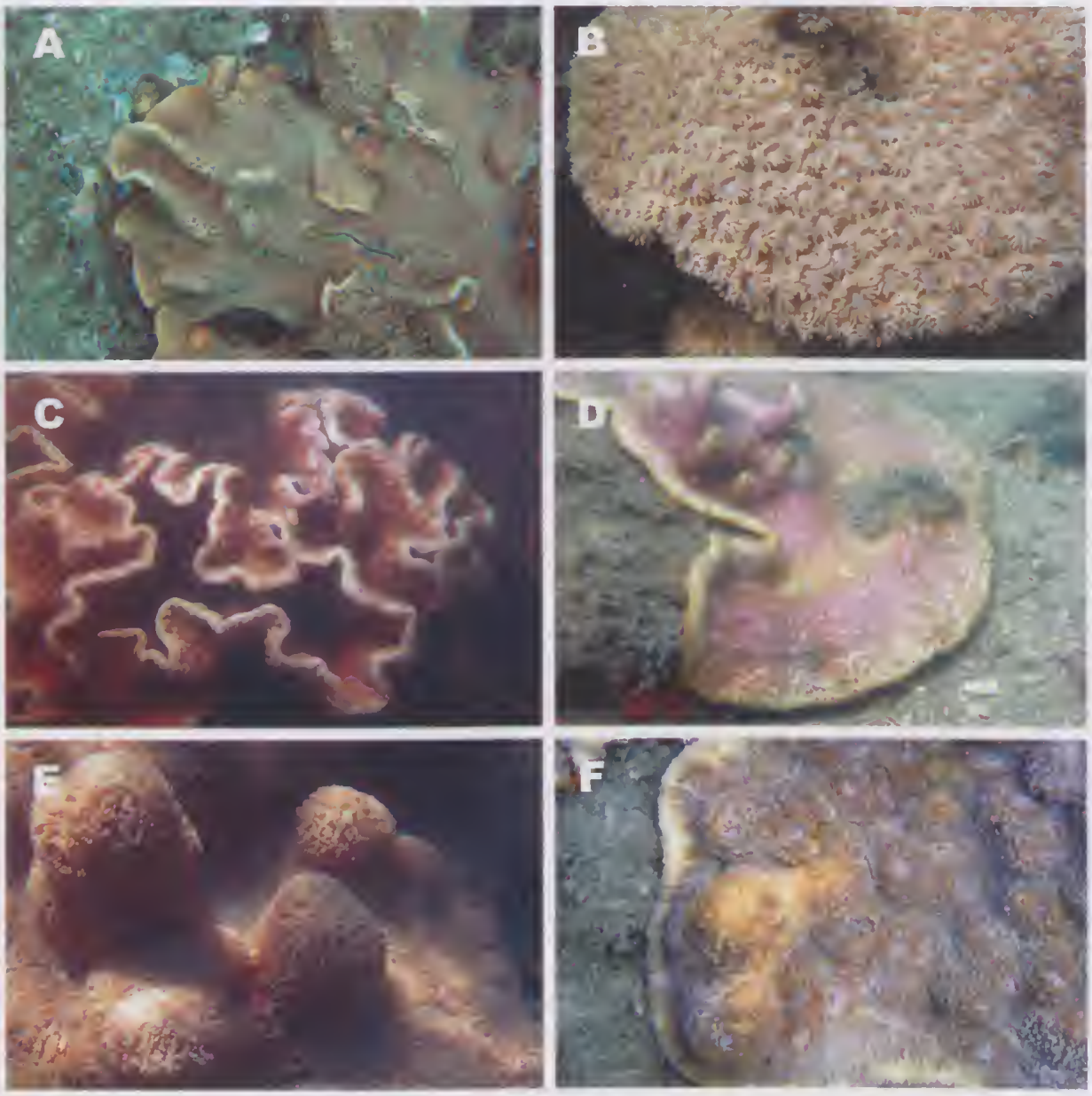

FIG 8. Field appearance. A, *Turbinaria frondens*; B, *Turbinaria peltata*; C, *Turbinaria patula*; D, *Turbinaria radicalis*; E, *Hydnophora exesa*; F, *Echinophyllia aspera*. Scale various.

SYSTEMATIC TREATMENT

Phylum CNIDARIA Hatschek, 1888

Class ANTHOZOA Ehrenberg, 1834

Subclass HEXACORALLIA

Order SCLERACTINIA Bourne, 1900

Suborder ASTROCOENIINA Vaughan & Wells, 1943

Diagnosis. Colonial, rarely solitary, Scleractinia with small corallites, septa formed by up to eight simple or compound trabeculae, appearing as simple spines to solid laminae, inclined in series from the wall rather than in divergent fan systems, dentate to practically smooth marginally. Polyps small with smooth stomodaea, rarely with more than 12 tentacles arranged in a single ring.

POCILLOPORIDAE Gray, 1842

Diagnosis. Plocoid, generally ramose, hermatypic corals with colony formation by extratentacular budding; septa rarely more than two cycles, reduced to narrow laminae, striae, or spines; columella styliform and vertically discontinuous; coenosteum solid or vesicular. *Upper Cretaceous to Recent.*

Pocillopora Lamarck, 1816

Type species. *Pocillopora acuta* Lamark, 1816.

Diagnosis. Ramose corals in which calices are commonly borne on short protuberances (verrucae) from the branches; septa rudimentary, represented by striae or spines. Endothecal dissepiments solid or tabular. Columella a low boss. *Eocene to Recent.*

Pocillopora damicornis (Linnaeus, 1758) (Figs 4H, 9)

Mittepora damicornis Linnaeus, 1758: 791. [Type locality: 'Asian Ocean' (probably Indonesia)].
Pocillopora acuta Lamarck, 1816: 274.
Pocillopora brevicornis Lamarck, 1816: 275.
Pocillopora bulbosa Ehrenberg, 1834: 351.
Pocillopora cespitosa Dana, 1846: 525, pl. 49, figs 5, 5a.
Pocillopora favosa Ehrenberg, 1834: 351.

Material Examined. *Living Moreton Bay*: MTQ-G56546 Peel I., IF, 2002; G57808, Myora, PLH, 1994; G58443, Amity Rock Wall, PRM, 2005; G60161, Goat I., CCW, PRM, 2007. *Fossil Moreton Bay*: recorded as subfossil from Goat and Mud Is (Wells 1966). *Living outside Bay*: QM-G6985, Flinders Reef, E. Lovell, 1971; GL3539, Flinders Reef, E. Lovell, 1973–74; MTQ-G35113–17, Flinders Reef, AIMS, pre 1984. *Further south*: recorded to SW Rocks (Harriott *et al.* 1999).

Skeletal Characteristics. Corallum ramose, caespitose, with a rounded outline, branches consisting of groupings of verrucae of various lengths up to 10 mm. Corallites rounded, calice diameter 0.9–1.6 mm; two cycles of septa and a columella plug just visible.

Field characteristics. Colonies are rounded in outline, with distinctive verrucae-based branching, reaching up to about 500 mm in diameter. Colours in Moreton Bay were pale brown or occasionally bright green.

Distribution. Widespread Indo-Pacific, from East Africa, Red Sea and Arabian Gulf to the Hawaiian Islands and western central Americas. East Australia: Great Barrier Reef south to SW Rocks, and east to Lord Howe Island, NSW.

Remarks. Past studies suggest this species has been absent or rare in Moreton Bay until about 2000. Harrison *et al.* (1998) refer to a small recently killed colony at Myora (MTQ-G7808) as 'the first record of the species ... within Moreton Bay', and Wells (1966) documents it only in subfossil assemblages. In 2005, colonies ranging from small juveniles to 400 mm in diameter occurred, in densities up to eight per sq. m, along the Amity rock wall. This indicates that the species is recruiting heavily via currents through South Passage and perhaps secondarily via larvae released from established colonies on the wall.

Further Literature. Hoffmeister (1927); Veron & Pichon (1976); Lovell (1989); Harriott *et al.* 1994, 1995; Banks & Harriott (1995); Harrison *et al.*

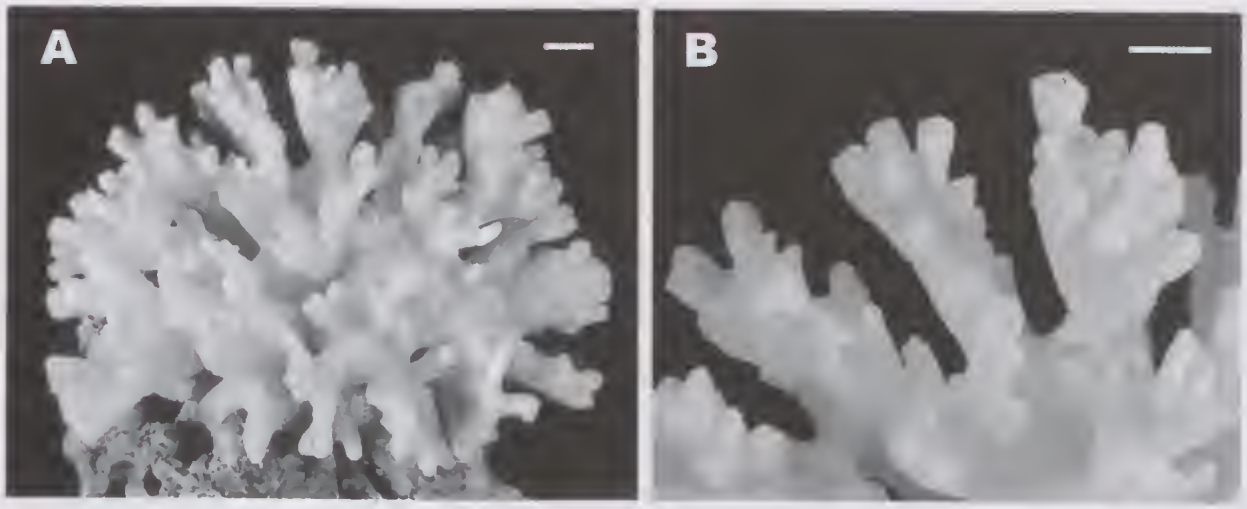

FIG. 9. *Pocillopora damicornis* from Peel Island (MTQ-G56546). A, whole colony. B, detail of branches. Scale bars: A = 10 mm; B = 5 mm.

(1998); Harriott (1999); Veron (2000); extensive literature cited in Veron & Pichon (1976).

ACROPORIDAE Verrill, 1902

Diagnosis. Massive or ramose colonies formed by extratentacular budding; hermatypic; corallites small, synapticulothecate, pseudocostate, slightly differentiated from coenosteum. Septa non-exsert, in two cycles, formed by simple spiniform trabeculae projecting inward and upward from vertical mural trabeculae, commonly fusing to form laminae. Columella absent or trabecular and weak. Dissepiments thin and tabular when developed. Coenosteum extensive, light, reticulate, flaky, generally spinose or striate on surface. *Upper Cretaceous to Recent.*

Acropora Oken, 1815

Type species. *Millepora muricata* Linnaeus, 1758 [original type locality 'Asian Ocean'; neotype locality Gunung Api I., Banda Is, Indonesia].

Diagnosis. Acroporidae which are ramose, rarely massive or encrusting, branching with single axial or leading corallites larger than the numerous radial corallites budded from them; radial corallites variously differentiated in shape; coenosteum light, reticulate, spinose, costate or pseudocostate; columella and dissepiments absent. *Paleocene to Recent.*

Remarks. The genus name *Acropora* Oken,1815, was validated by the International Commission on Zoological Nomenclature in Opinion 674, 1963 (Boschma, 1961; China, 1963).

The *Acropora humilis* Group

Diagnosis. Radial corallites short, thickened tubular, with round to dimidiate openings, evenly sized or in two sizes, coenosteum throughout reticulate with laterally flattened irregular spinules, sometimes reticulo-costate; colony corymbose or digitate.

Acropora samoensis (Brook, 1891)
(Figs 3H, 10C, D)

Madrepora samoensis Brook, 1891: 468; 1893:143, pl. 31, fig. A, pl. 6, fig. C [Type locality: Samoa].

Acropora wallaceae Veron, 1990: 90, figs 4–6.

Material Examined. LECTOTYPE, NHM-1875.10.2.8, Samoa. *Living Moreton Bay*: MTQ-G60061, Myora, CCW, PRM, 2007. *Fossil Moreton Bay*: MTQ-G58855, Mud I. CCW, IF, PRM, 2005; *Living outside Bay*: Flinders Reef, recorded Veron (1993); CCW, 2005.

Skeletal Characteristics. Corallum caespitose to caespito-corymbose, branches terete or with a moderate taper, 8–15 mm diameter, up to 30mm long. Axial corallites outer diameter 2.7–4.5 mm, inner diameter 0.5–1.8 mm; radial corallites tubular with round to oblique or dimidiate openings, mostly not touching on branches, may be interspersed with immersed corallites. Coenosteum a dense arrangement of laterally flattened elaborated spinules throughout, sometimes in lines on radial corallites.

Field Characteristics. Colonies are distinguished within the *Acropora humilis* group by more branching within the corymbose structure, and by corallites that are mainly not touching. The species has two main colour forms, pale brown or blue, and the one colony seen to date in the bay was blue (Fig. 3H).

Distribution. Widespread Indo-Pacific, from East Africa, and Red Sea east to Pitcairn Islands. East Australia: Great Barrier Reef south to the Moreton Bay region.

Remarks. The one sample recorded was collected in April 2007 within South Passage, and this may reflect the suitability of changing water conditions in the bay for this species.

Further Literature. Wallace (1978, 1999); Veron & Wallace (1984); Banks & Harriott (1995); Veron (2000); Wolstenhome *et al.* (2003).

Acropora digitifera (Dana, 1846)
(Figs 3E; 10A–B)

Madrepora digitifera Dana, 1846: 454 [Type locality: Marshall Islands].

Madrepora pyramidalis Klunzinger, 1879: 12, pl. 1, fig. 2, pl. 4, fig. 6, pl. 9, fig. 7.

Madrepora leptocyathus Brook, 1891: 463; 1893: 159, pl. 16, fig. C.

Madrepora brevicollis Brook, 1892: 454; 1893: 159, pl. 27, figs A–B.

Madrepora baeodactyla Brook, 1892: 453; 1893: 158, pl. 13, figs A–B.

Madrepora wardii Verrill, 1902: 248, pl. 36, fig. 3, pl. 36B, fig. 4, pl. 36F, fig. 4.

Acropora schmitti Wells, 1950: 39, figs 1–2.

Material Examined. NEOTYPE: MTQ-G37980, Arno Atoll, Marshall Is. *Living Moreton Bay*: MTQ-G56608, Myora, IF, 2002; G57487, Peel I., CCW, IF, PRM, 2003; MTQ-G57504–505, Myora, CCW, IF, PRM, 2003; MTQ-G57506, Peel I., CCW, IF, PRM, 2003; MTQ-G56543, Myora, IF, 2002; MTQ-G60091–92, Myora, CCW, PRM, 2007; QM: Great Barrier Reef Committee Coll. No. 224, Peel I., C. Hedley, 1929. *Fossil Moreton Bay*: MTQ-G58846, Mud I., CCW, IF, PRM, 2003; MTQ-G58847–48, Mud I., CCW, IF, PRM, 2005; MTQ-G58849, Mud I., IF, 2002. Recorded as subfossil from Mud I. by Wells (1955). *Living outside Bay*: QM-G7287, Flinders Reef, E. Lovell, 1973; MTQ-G30023, G35768, Flinders Reef, AIMS, pre 1984; Flinders Reef, visual record CCW, 2005. *Further south*: MTQ-G58595, Solitary Is, V. Harriott, S. Banks, 1995; QM-G7059, Solitary Is, J. Veron *et al.*, 1973.

Skeletal Characteristics. Corallum corymbose, branches terete or with a moderate taper, 8–15 mm diameter, up to 30 mm long. Axial corallites outer diameter 2.2–3.8 mm, inner diameter 0.6–1.6 mm; radial corallites dimidiate, evenly sized and arranged close together, with thickened walls and little or no inner wall, so that lower wall looks like a lip. Coenosteum a dense arrangement of laterally flattened elaborated spinules, sometimes in lines, on radial corallites, dense reticulate with elaborate spinules in intercorallite areas.

Field Characteristics. Corymbose colonies, sometimes extending up to 5 m in one diameter, colour greenish brown, usually with green or bluish-green tips.

Distribution. Widespread Indo-Pacific, from Red Sea and East Africa to Pitcairn Islands. East Australia: Great Barrier Reef south to Solitary Islands, NSW (Harriott *et al.* 1994).

Remarks. Wolstenholme & Wallace (2003) show that boundaries of this species encompass a second (possibly unnamed) species, however Moreton Bay material agrees with the *A. digitifera* type. Abundant mature colonies of *A. digitifera* occur at Myora and parts of Peel Island reef, with some apparently continuous colonies measuring up to 5 m along one axis. These colonies were noted to be gravid with

gametes maturing prior to spawning by Harrison *et al.* (1998).

Further Literature. Wallace (1978, 1999); Lovell (1989); Veron & Wallace (1984); Wallace & Wolstenholme (1998); Veron (2000); Wilson & Harrison (2003); Wolstenhome *et al.* (2003).

The *Acropora nasuta* Group

Diagnosis. Radial corallites mostly nariform or tubo-nariform, evenly sized or in two sizes, coenosteum throughout reticulate with simple spinules, in some species being arranged in rows or coalesced into costae, colony corymbose or digitate.

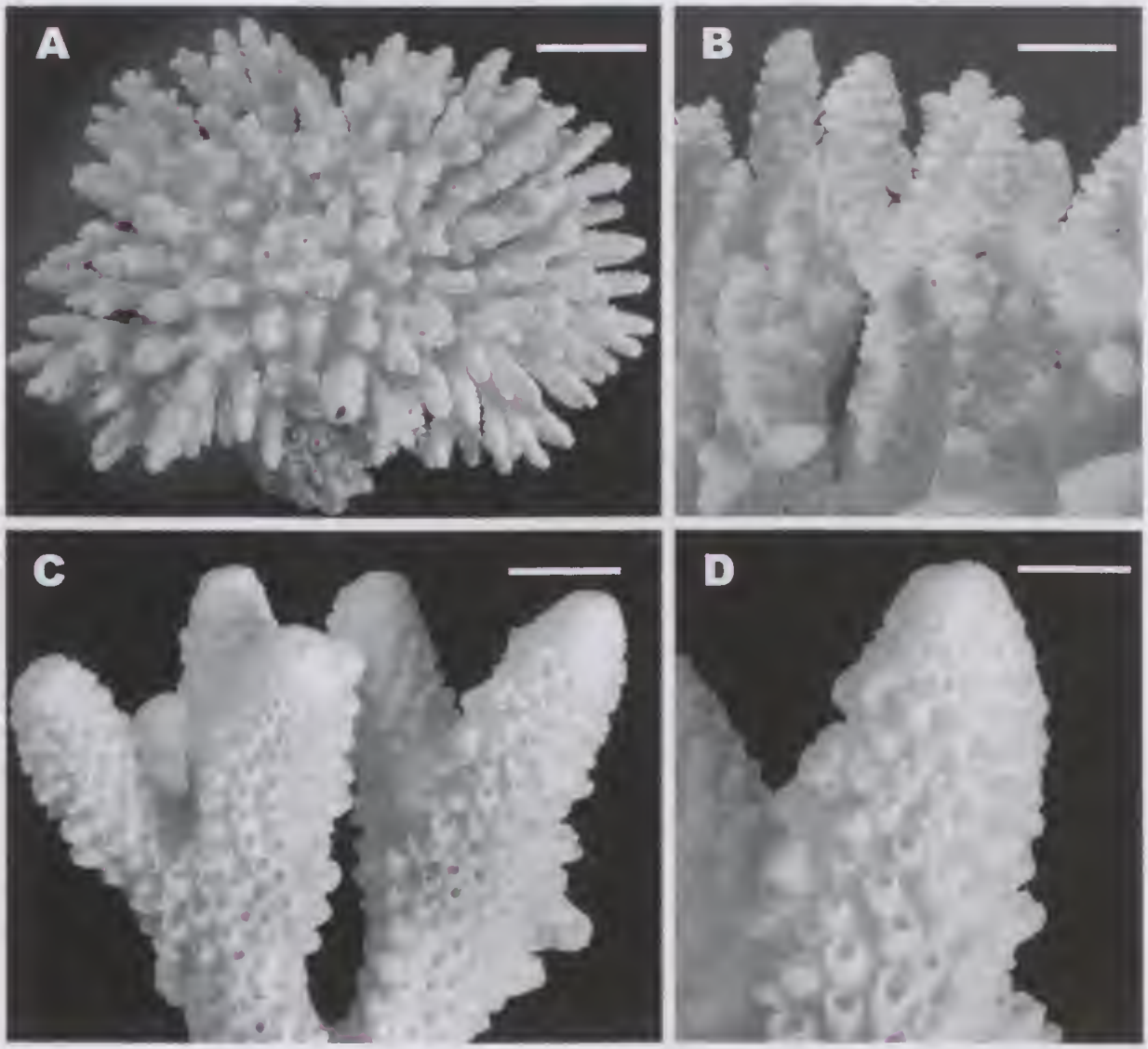

FIG. 10. *Acropora "humilis* group 1": A, B, *Acropora digitifera* from Myora (MTQ-G56608). A, whole colony. B, detail of branches. C, D, *Acropora samoensis* from Myora (MTQ-G60061). C, whole colony. D, detail of branches. Scale bars: A = 50 mm; B, D = 5 mm; C = 10 mm.

Acropora nasuta (Dana, 1846) (Figs 3C, 11)

Madrepora nasuta Dana, 1846: 453, pl. 34, fig. 2 [Type Locality: Tahiti].

Madrepora effusa Dana, 1846: 455.

Madrepora canaliculata Klunzinger, 1879: 12, pl. 1, fig. 3, pl. 4, fig. 10.

Acropora diomedeae Vaughan, 1906: 69, pl. 7, figs 1–1a, pl. 8, figs 2–3.

Material Examined. LECTOTYPE: USNM 260, Tahiti. *Living Moreton Bay*: MTQ-G58425, G58429, Amity Rock Wall, CCW, IF, PRM, 2005; MTQ-G60088, Myora, CCW, PRM, 2007. *Living outside Bay*: MTQ-G58420, Shag Rock, CCW, IF, PRM, 2005; MTQ-G30146, G30772, G30862, G31042, G31048, Flinders Reef, AIMS, pre 1984; Flinders Reef, visual record CCW, 2005.

Skeletal Characteristics. Corallum corymbose, arising from a central to side attachment; branches tapering, 7–12 mm in diameter and up to 70 mm long. Axial corallites outer diameter 1.4–3.0 mm, inner diameter 0.5–1.1 mm; radial corallites nariform, with rounded to slightly dimidiate openings, evenly sized and arranged close together. Coenosteum densely costate or lines of laterally flattened spinules on radial corallites, reticulate with scattered spinules in intercorallite areas.

Field Characteristics. Stalked to side-attached colonies, up to around 300 mm diameter; colour pale brown or yellow-brown.

Distribution. Widespread Indo-Pacific from East Africa, Red Sea and Arabian Gulf to Pitcairn Islands. East Australia: Great Barrier Reef south to Solitary Islands, NSW (Harriott *et al.* 1994).

Remarks. This is the first record of *Acropora nasuta* for Moreton Bay, where two or three colonies were observed in one dive on the artificial wall at Amity. Its presence there indicates its potential to colonise under some conditions.

Further Literature. Wallace (1978, 1999); Veron & Wallace (1984); Harriott *et al.* 1994; Wallace

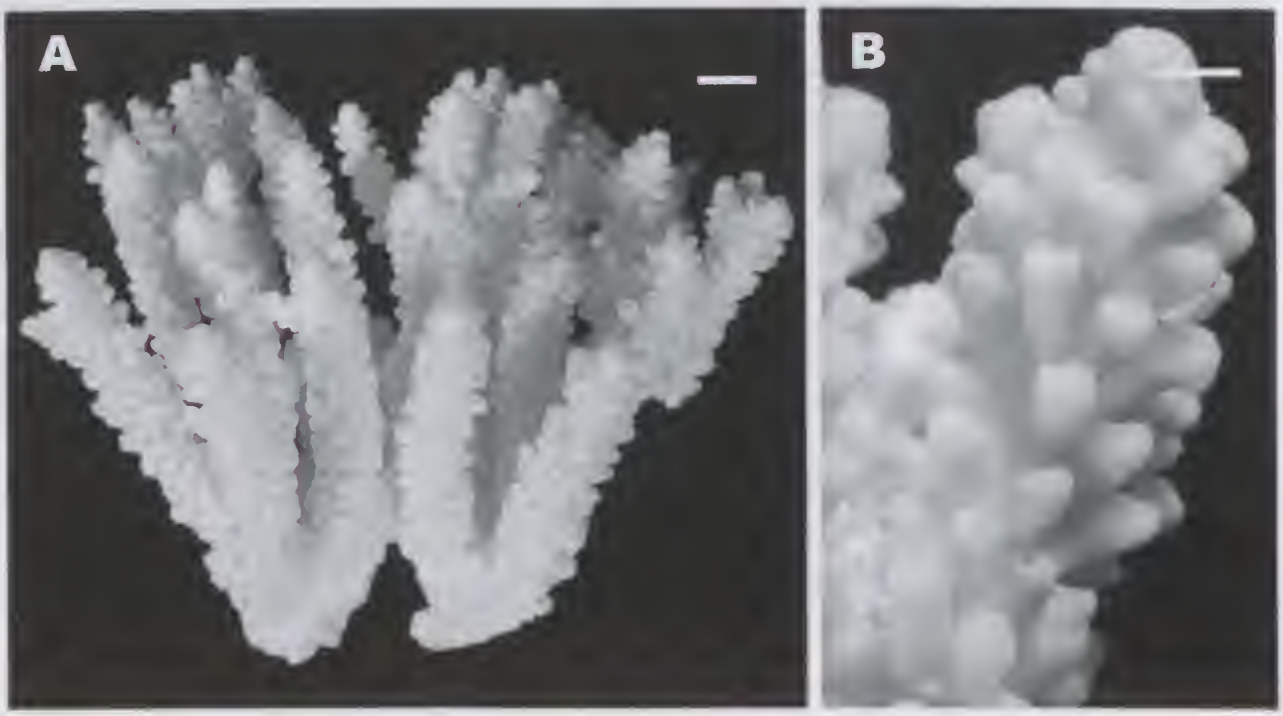

FIG.11. *Acropora nasuta* from Amity (MTQ-G58429). A, portion of colony. B, detail of branches. Scale bars: A = 10 mm; B, 2 mm.

& Wolstenholme (1998); Veron (2000); Wilson & Harrison (2003).

Acropora valida (Dana, 1846) (Figs 3A, 12)

Madrepora valida Dana, 1846: 461, pl. 35, fig. 1 [Type Locality: Fiji].

Madrepora variabilis Klunzinger, 1879: 17, pl. 1, fig. 10; pl. 2, figs 1, 5; pl. 5, figs 1, 3; pl. 9, fig. 14.

Madrepora coalescens Ortmann, 1889: 509, pl. 13, fig. 5.

Acropora dissimilis Verrill, 1902: 226, pl. 34, fig. 9.

Material Examined. HOLOTYPE: USNM 272, Fiji. *Living Moreton Bay*: MTQ-G35800 Green I. PLH, 1991; MTQ-G58424, G58426–27, Amity Rock Wall, CCW, IF, PRM, 2005; MTQ-G60096–97 Myora, CCW, PRM, 2007. *Fossil Moreton Bay*: MTQ-G30108, G30110–11, G30113, Amity, Pickett *et al.* (1985); recorded as subfossil from Mud I. (as *A. variabilis*) by Wells (1955). *Living outside Bay*: MTQ-G30622, G31066, G31073, G31076, Flinders Reef, AIMS, pre 1984; QM-G6986, Flinders Reef, E. Lovell (1972). *Further south*: recorded to Solitary Is (Harriott *et al.* 1999).

Skeletal Characteristics. Corallum corymbose to caespito-corymbose or caespitose, branches tapering, 7–20 mm diameter and up to 60 cm long. Axial corallites outer diameter 1.6–2.8 mm, inner diameter 0.5–0.9 mm; radial corallites of equal or mixed sizes, touching on branches, appressed tubular or tubo-nariform, with rounded or slightly elongate openings. Coenosteum reticulate with densely and evenly arranged spinules both on and between radial corallites, sometimes costate on radial corallites in lightly calcified specimens.

Field Characteristics. Only small caespitose colonies, lavender in colour, have been seen on Myora reef flat.

Distribution. Widespread Indo-Pacific from East Africa, Red Sea and Arabian Gulf to Pitcairn Islands, with occasional occurrence off the Colombian coast. East Australia: Great Barrier Reef south to Solitary Islands, NSW, and east to Lord Howe Island.

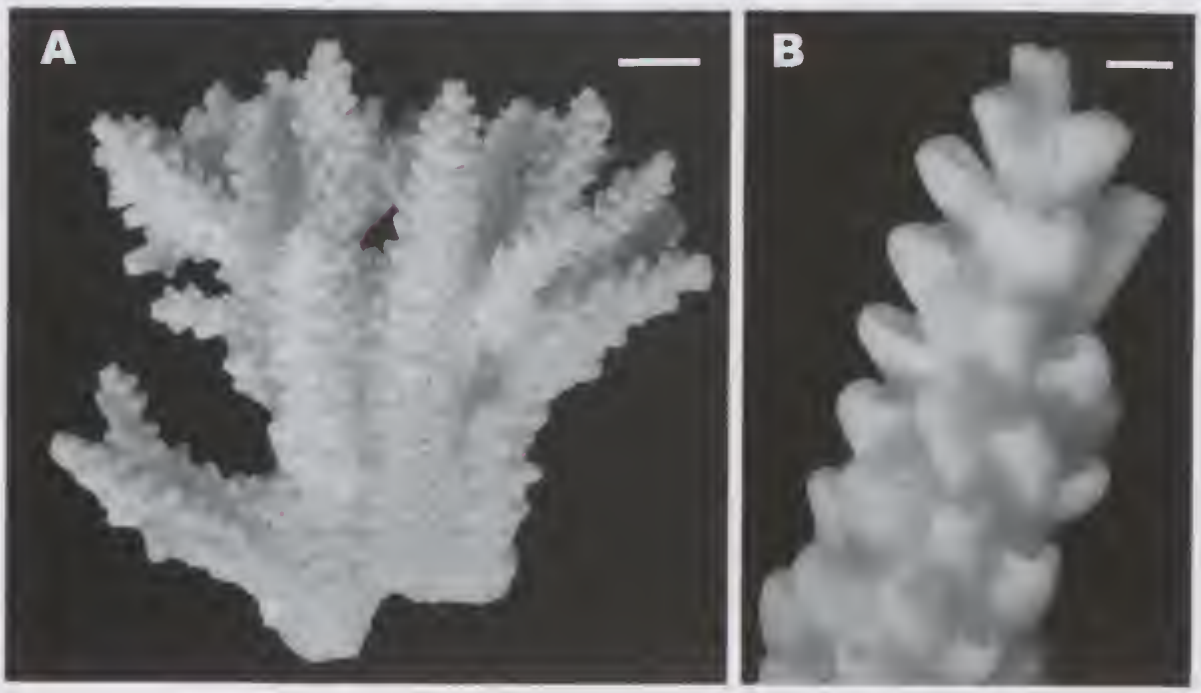

FIG. 12. *Acropora valida* from Amity (MTQ-G58424). A, portion of colony. B, detail of branch. Scale bars: A, 10 mm; B, 2 mm.

Remarks. This, the most widespread *Acropora* species, does not appear to have ever been common within the bay, but its presence in SE Australia is established from the Pleistocene (135,000 ya) Stradbroke Island record from Pickett *et al.* (1985, revised age estimate 1989).

Further Literature. Wallace (1978, 1999); Veron & Wallace (1984); Banks & Harriott (1995); Wallace & Wolstenholme (1998); Veron (2000); Harriott *et al.* (1994, 1995, 1999); Wilson & Harrison (2003).

Acropora lutkeni Crossland, 1952
(Fig. 13)

Acropora lutkeni Crossland, 1952: 229, pl. 41, fig. 1, pl. 46, fig 2. [Type locality: June Reef, Great Barrier Reef].

Material Examined. HOLOTYPE: NHM-1934.5.14.16, June Reef, Great Barrier Reef. *Living Moreton Bay*: MTQ-G57488, Myora, CCW, IF, PRM, 2003. *Living outside Bay*: MTQ-G30611, G32729– 30, G32736, Flinders Reef, AIMS, pre-1984; Flinders Reef, visual record CCW, 2005; MTQ-G58416, Shag Rock, CCW, IF, PRM, 2005. *Further south*: MTQ-G47278, Solitary Is, V. Harriott, S. Banks (1992).

Skeletal Characteristics. Corallum irregular digitate with sturdy tapering branches 10–45 mm in diameter arising from a central to side-attached base but may end at different heights up to 80 mm long. Axial corallites outer diameter 1.9–4.3 mm, inner diameter 0.6–1.2 mm; radial corallites large and small sizes up to 5 mm long, touching or just separated on branches, tubular with mostly rounded or slightly nariform openings. Coenosteum a dense arrangement of laterally flattened spinules on radial corallites, reticulate with flaky spinules in intercorallite areas.

Field Characteristics. Irregular digitate colonies, up to 400 mm in diameter raised on a short stalk; colour pale lavender or brownish-lavender.

Distribution. Widespread Indo-Pacific from East Africa to Pitcairn Islands. East Australia: Great Barrier Reef south to Solitary Islands, NSW.

Remarks. This broadly distributed species is usually associated with exposed, high energy reef front (Wallace 1999). This is the first record of the species within Moreton Bay.

Further Literature. Wallace (1999); Veron & Wallace (1984); Harriott *et al.* (1994); Wallace & Wolstenholme (1998); Veron (2000); Wilson & Harrison (2003).

The *Acropora divaricata* Group

Diagnosis. Radial corallites open nariform with thickened walls and wide open, round, oblique or dimidiate openings (sometimes all within a colony), evenly sized or in mixed sizes; coenosteum throughout reticulate with forked or simple spinules. Colonies determinate in growth, from a central to side-attached point of origin.

Acropora divaricata (Dana, 1846)
(Figs 3B, 14)

Madrepora divaricata Dana, 1846: 477, pl. 41, figs 2–2a. [Type locality: Fiji].
Madrepora tenuispicata Studer, 1880: 20, figs 1a–b.
Madrepora scabrosa Quelch, 1886: 152, pl. 10, fig. 2.
Acropora stoddarti Pillai & Scheer, 1976: 27 pls 5–6.

Material Examined. HOLOTYPE: USNM-299, Fiji. *Living Moreton Bay*: MTQ-G56542, G56547, Myora, IF, 2002; MTQ-G56544, Myora, CCW, IF, PRM, 2003; MTQ-G60090 Myora, CCW, PRM, 2007; MTQ-G57806, Peel I. PLH, 1994; MTQ-G60195, Green I., CCW, PRM, 2007. *Fossil Moreton Bay*: MTQ-G57508, Mud I., CCW, IF, PRM, 2003. *Living outside Bay*: MTQ-G28901, G32189, Flinders Reef, AIMS, pre 1984. *Further south*: MTQ-G58497, Solitary Is, V. Harriott, S. Banks (1995).

Skeletal Characteristics. Corallum open caespito-corymbose with tapering branches 5–15 mm diameter and up to 70 mm long, curving and anastomosing to form a network within the colony. Axial corallites outer diameter 1.8–3.0 mm, inner diameter 0.7–1.1 mm; radials evenly sized and spaced on branches, just touching, nariform, with large, open calices; distally radial corallites are tubo-nariform and towards the base of branches they may be appressed tubular; sometimes radial corallite walls extended outwards by rostrate development.

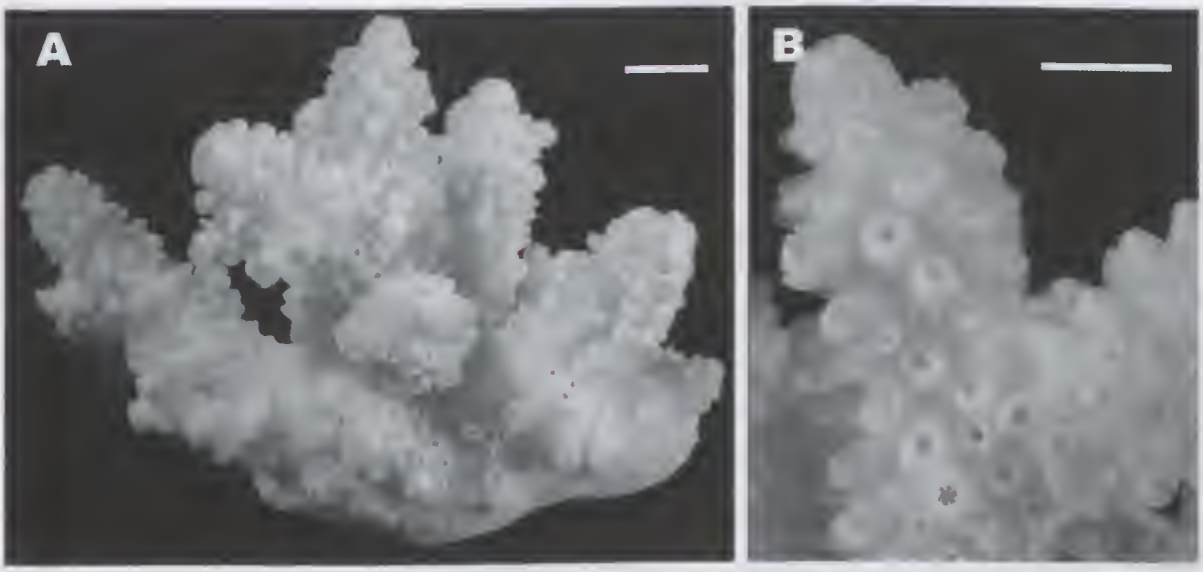

FIG. 13. *Acropora lutkeni* from Myora (MTQ-G57488). A, portion of colony. B, detail of branch. Scale bars: 10 mm.

Coenosteum reticulate with dense arrangement or rows of laterally flattened or forked spinules on radial corallites; reticulate with spinules less densely arranged in intercorallite areas.

Field Characteristics. Colonies with distinctive divergent branching pattern within a rounded arborescent-table outline; the upper surface of small final branches sometimes naked of radial corallites. Colonies at Myora were up to 500 mm in diameter and coloured lavender or pinkish- or greyish-lavender.

Distribution. Widespread Indo-Pacific from East Africa, Red Sea and Arabian Gulf to Samoa. East Australia: Great Barrier Reef south to Solitary Islands, NSW.

Remarks. The species *Acropora divaricata* and *A. solitaryensis* are sometimes difficult to distinguish, but colonies in the bay were consistently identifiable from both their colony shapes and their colouration.

Further Literature. Wallace (1978, 1999); Veron & Wallace (1984); Wallace & Wolstenholme (1998); Veron (2000).

Acropora solitaryensis Veron & Wallace, 1984 (Fig. 15)

Acropora solitaryensis Veron & Wallace, 1984: 371, figs 916, 922, 928. [Type Locality: Solitary Is, New South Wales].

Material Examined. HOLOTYPE: MTQ-G52082, North Solitary I., NSW; PARATYPE: MTQ-G52083, North Solitary I., NSW. *Living Moreton Bay*: MTQ-G56553, G57495, Myora, CCW, IF, PRM, 2003; G58397- 398, Myora, CCW, IF, PRM, 2005; MTQ-G58489–90, Amity Point, CCW, IF, PRM, 2005; MTQ-G58517, Peel I., PLH, 1994; MTQ-G60234–236, Green I. Fisheries Research Consultants, 1994; MTQ-G58509, Moreton Bay, CCW, IF, PRM, 2003; QM-G5892 Green I., C. Horan (Wallace), 1971; MTQ-G58512, Goat I., PLH, IF, 2005. *Fossil Moreton Bay*: MTQ-G57493, Mud I., CCW, IF, PRM, 2003; MTQ-G57494, Empire Point, CCW, IF, PRM, 2003; QM-G5892, Green I., M. Dredge, 1971. *Living outside Bay*: MTQ-G27006–07, G27009, G27012, G27482–84, G27486, G27490–91, G27497, G27499–500, Flinders Reef, AIMS, pre 1984. QM-G7300, Flinders Reef, E. Lovell, 1972; QM-G7330 Flinders Reef, E. Lovell, 1972; Flinders Reef, visual record CCW, 2005. *Further south*: MTQ-G27013, G27487–88, G27494–95, G27501, North Solitary I., AIMS, 1978–1984); MTQ-G47055–62, Solitary Is, V. Harriott, P. Harrison, 1992.

Skeletal Characteristics. Corallum tabulate, table tops being formed by anastomosing and upwardly curving, tapering branches, 5–15 mm in diameter and up to 45 mm long. Corallites:

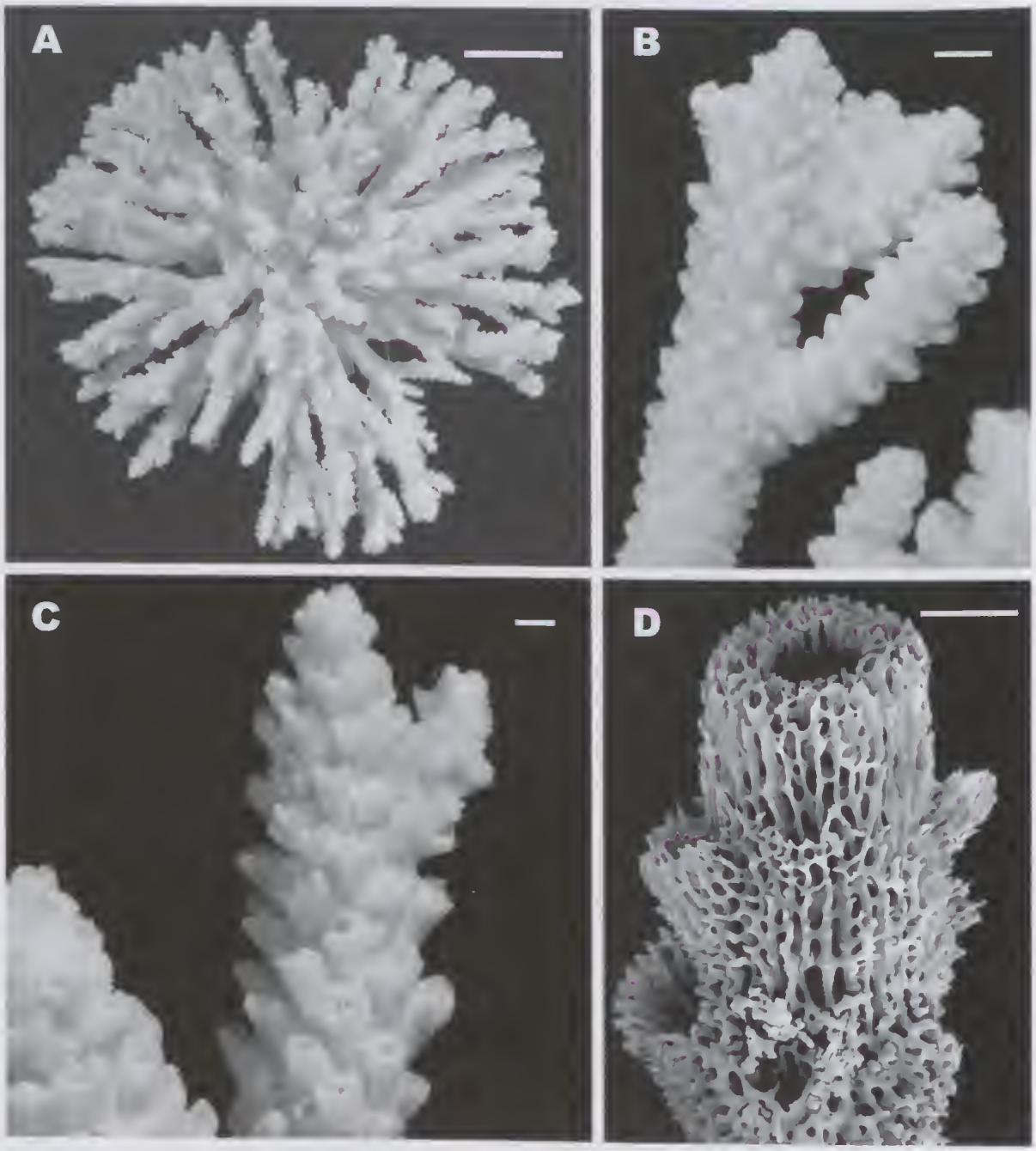

FIG. 14. *Acropora divaricata*: A, B, D, from Myora (MTQ-G56547); C, from Lazaret Gutter, Peel Island (MTQ-G57806). A, whole colony. B, C, detail of branches. D, scanning electron micrograph of branch tip. Scale bars: A = 50 mm; B, C = 10 mm; D = 1 mm.

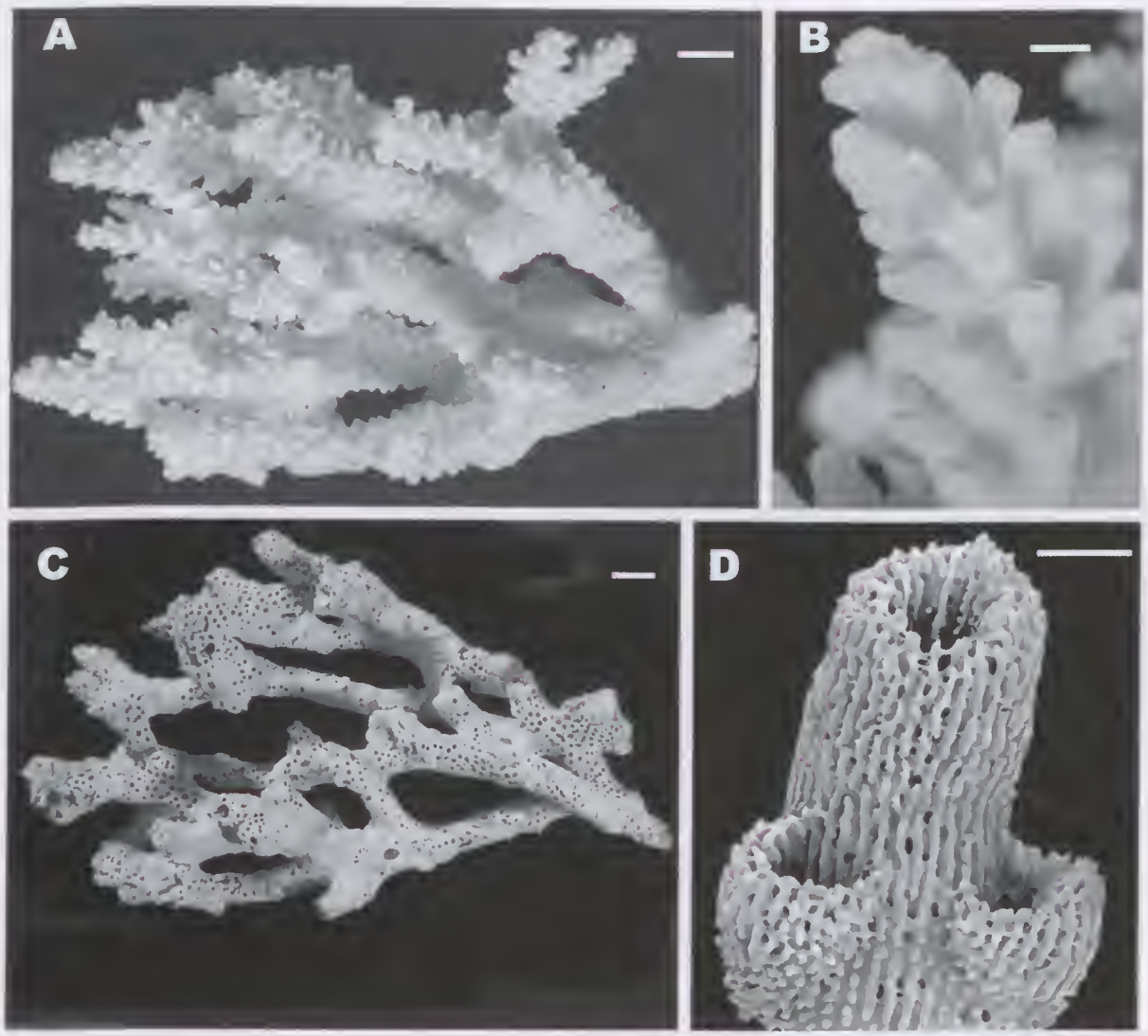

FIG. 15. *Acropora solitaryensis*: A, B, D, from Green Island (QM-G5892); C, fossil from Empire Point (MTQ-G57494). A, C, portion of colony. B. detail of branch. D, scanning electron micrograph of branch tip. Scale bars: A, C = 10 mm; B, D = 1 mm.

axials outer diameter 1.6–3.4 mm, inner diameter 0.5–1.1 mm; radial corallites evenly sized and arranged, nariform or tubo-nariform, with large, open calices; distally radials are tubo-nariform and towards the base of branches they may be appressed tubular; sometimes radial corallite walls extended upwards by rostrate development. Coenosteum reticulate with dense arrangement or rows of laterally flattened or forked spinules on radial corallites, reticulate with spinules less densely arranged in intercorallite areas.

Field Characteristics. Colonies occur as brackets or tables up to 500 mm in diameter, colour greenish brown, usually with blue branch tips.

Distribution. Indo-Pacific from East Africa to Austral Is. East Australia: Great Barrier Reef south to Solitary Islands, NSW, and east to Lord Howe Island.

Remarks. Along with *Acropora glauca*, this species occurs abundantly along the S. Queensland and northern NSW coasts and offshore islands. It was initially thought to be a sub-tropical species (Veron & Wallace 1984 : 198), but is now known to occur abundantly throughout the Indo-Australian arc and its habitat preference appears to be fringing reefs (Wallace 1999).

Further Literature. Harrison & Veron (1993); Banks & Harriott (1995); Wallace & Wolstenholme (1998); Harriott *et al.* (1994, 1995); Wallace (1999); Veron (2000); Wilson & Harrison (2003).

The *Acropora lovelli* Group

Diagnosis. Radial corallites appressed tubular with large rounded openings, evenly sized; coenosteum throughout reticulate with simple spinules, sometimes arranged in rows or costae, colony form various.

Acropora glauca (Brook, 1893) (Figs 3D, 16)

Madrepora glauca Brook, 1893: 164, pl. 34, fig. D. [Type locality: Western Australia].

Material Examined. HOLOTYPE NHM-1886.2.26.7 (GB502), Western Australia. *Living Moreton Bay*: MTQ-G57496, G57502, Peel I., CCW, IF, PRM, 2003; MTQ-G58508, Peel I., PLH, 1994; MTQ-G30330, G30332, Myora, AIMS, 1975–1983; MTQ-G57497–500, G57504 Myora, CCW, IF, PRM, 2003; MTQ-G57501, G57503, G58518, Green I., CCW, IF, PRM, 2003; MTQ-G58428 Amity Rock Wall, CCW, IF, PRM, 2005; G57824–25, Moreton Bay, PLH, 1994; G58510–11, Goat I., PLH, IF, 2005. QM-G2647, Moreton Bay, W. Stephenson, J.W. Wells (1954). *Fossil Moreton Bay*: MTQ-G58853, Empire Point, CCW, IF. PRM, 2003; MTQ-G58856–57, Mud I. CCW, IF, PRM, 2005. *Living outside Bay*: MTQ-G28196, G28205–06, G28208–09, G28212–13, G28215–17, Flinders Reef, AIMS, pre 1984; QM-G7293–94, Flinders Reef, E. Lovell, 1973; visual record CCW, IF, 2005. *Further south*: MTQ-G28059, G28062, G28201, G28303, North Solitary I., AIMS, 1978–1984; MTQ-G47063–69, Solitary Is, AIMS 1978–1984; MTQ-G47279–90, Solitary Is, V. Harriott, S. Banks, 1992; MTQ-G58493 Solitary Is, V. Harriott, S. Banks, 1995.

Skeletal Characteristics. Corallum corymbose to corymbose plates with terete branches, 6–15 mm in diameter and up to 50 mm long. Axial corallites outer diameter 2.3–4.1 mm, inner diameter 0.9–1.3 mm; radial corallites evenly distributed, equal shapes and sizes, appressed rounded tubular with large round openings. Coenosteum reticulate or finely costate throughout.

Field Characteristics. Colonies are corymbose, usually standing alone and not usually exceeding about 500 mm in diameter. Colour is brown or greenish brown.

Distribution. Indo-Pacific from Seychelles and Red Sea to Marshall Islands. East Australia: Great Barrier Reef south to Solitary Islands, NSW, and east to Lord Howe Island.

Remarks. This species is typically restricted to fringing reefs, in both tropical and subtropical waters. It can appear quite similar to *Acropora digitifera* in the bay, and is most reliably separated from that species by its very rounded corallite openings, in contrast to the dimidiate or lipped appearance of *A. digitifera* corallites. *A. glauca* does not appear to form the extensive colonies seen in *A. digitifera*. Although *A. glauca* has not previously been reported in the literature, a large specimen from Moreton Bay without data is probably more than 50 years old. This, plus the 1954 sample of Stephenson & Wells, and the fossils listed above, indicates a long history in the bay.

Further Literature. Veron & Wallace (1984); Banks & Harriott (1995); Harriott *et al.* (1995); Wallace (1999); Wilson & Harrison (2003).

Acropora verweyi Veron & Wallace, 1984 (Fig. 17)

Acropora verweyi Veron & Wallace, 1984: 191, figs 446, 449, 450, 453. [Type locality: Magdelaine Cay, Great Barrier Reef].

Material Examined. HOLOTYPE: MTQ-G55076, Magdalaine Cay, NE Australia. *Living Moreton Bay*: MTQ-G35801, Peel I., PLH, 1991; MTQ-G57487, Peel I., CCW, IF, PRM, 2003; MTQ-G57827–28, Myora, PLH, 1994; MTQ-G58488, Myora, IF, 2001; MTQ-G57486, Myora, CCW, IF, PRM, 2003. *Living outside Bay*:

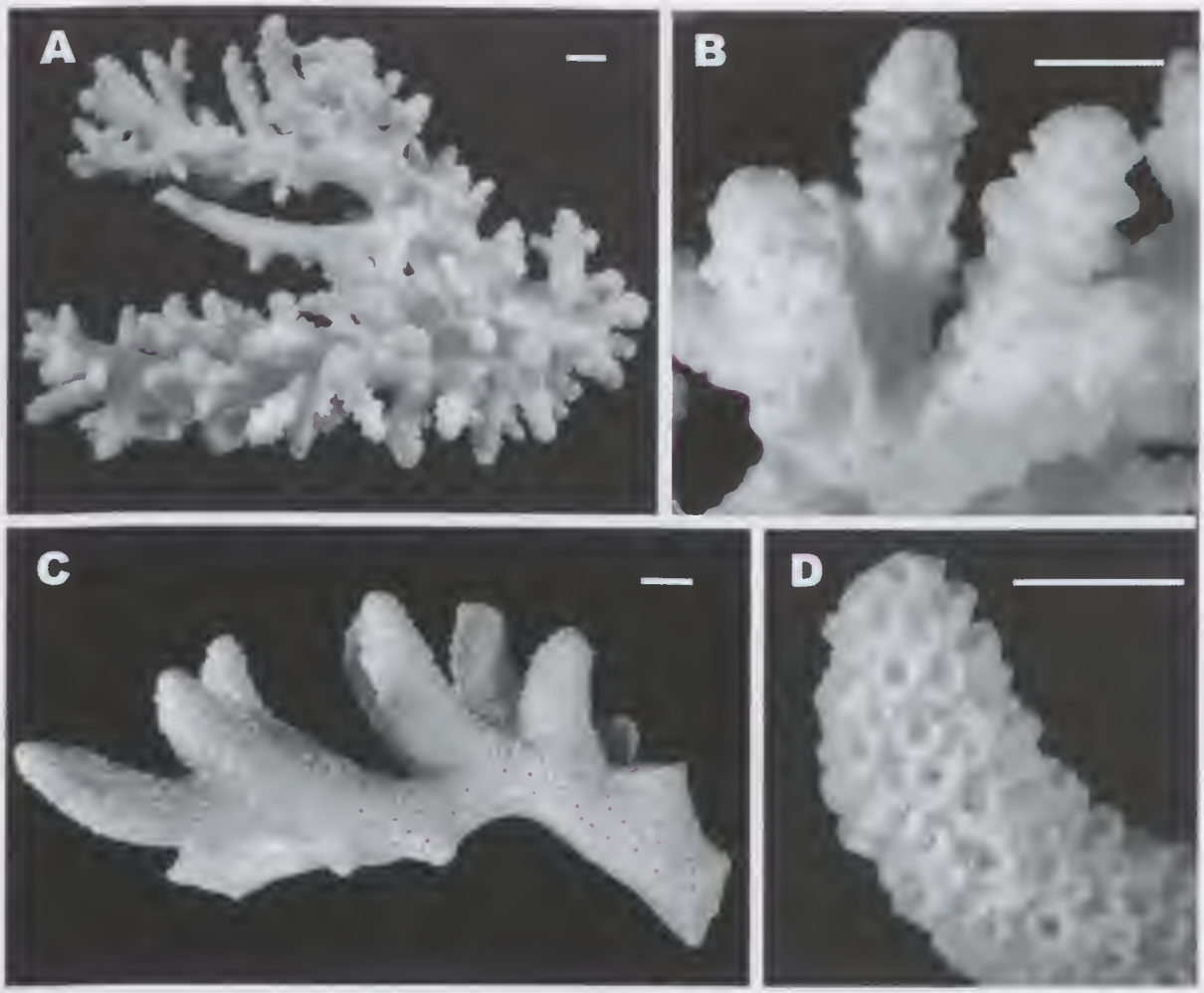

FIG. 16. *Acropora glauca*: A, B, from Peel Island (MTQ-G57496); C, D, from Green Island (MTQ-G57503). A, C, portion of colony. B, D, detail of branches. Scale bars: 10 mm.

MTQ-G28117, G28131, G33321, G33348, Flinders Reef, AIMS, pre 1984.

Skeletal Characteristics. Corallum digitate or caespito-corymbose, with terete branches 5–10 mm in diameter and up to 10 mm long. Axial corallites outer diameter 2.8–3.5 mm, inner diameter 0.8–1.1 mm; radial corallites evenly distributed, equal shapes and sizes, appressed rounded tubular with large flaring round openings. Coenosteum reticulate with lines of simple or laterally flattened spinules throughout.

Field Characteristics. Occurs in low, irregular patches which are pinkish cream in colour, among the inner Myora coral patches.

Distribution. Indo-Pacific from Comoros in the west to Pitcairn Islands in the east, but not known from the Indo-Australian Arc (Indonesia). East Australia: Great Barrier Reef south to Moreton Bay region.

Remarks. This species was first collected in Moreton Bay by Harrison *et al.* (1991), which in-

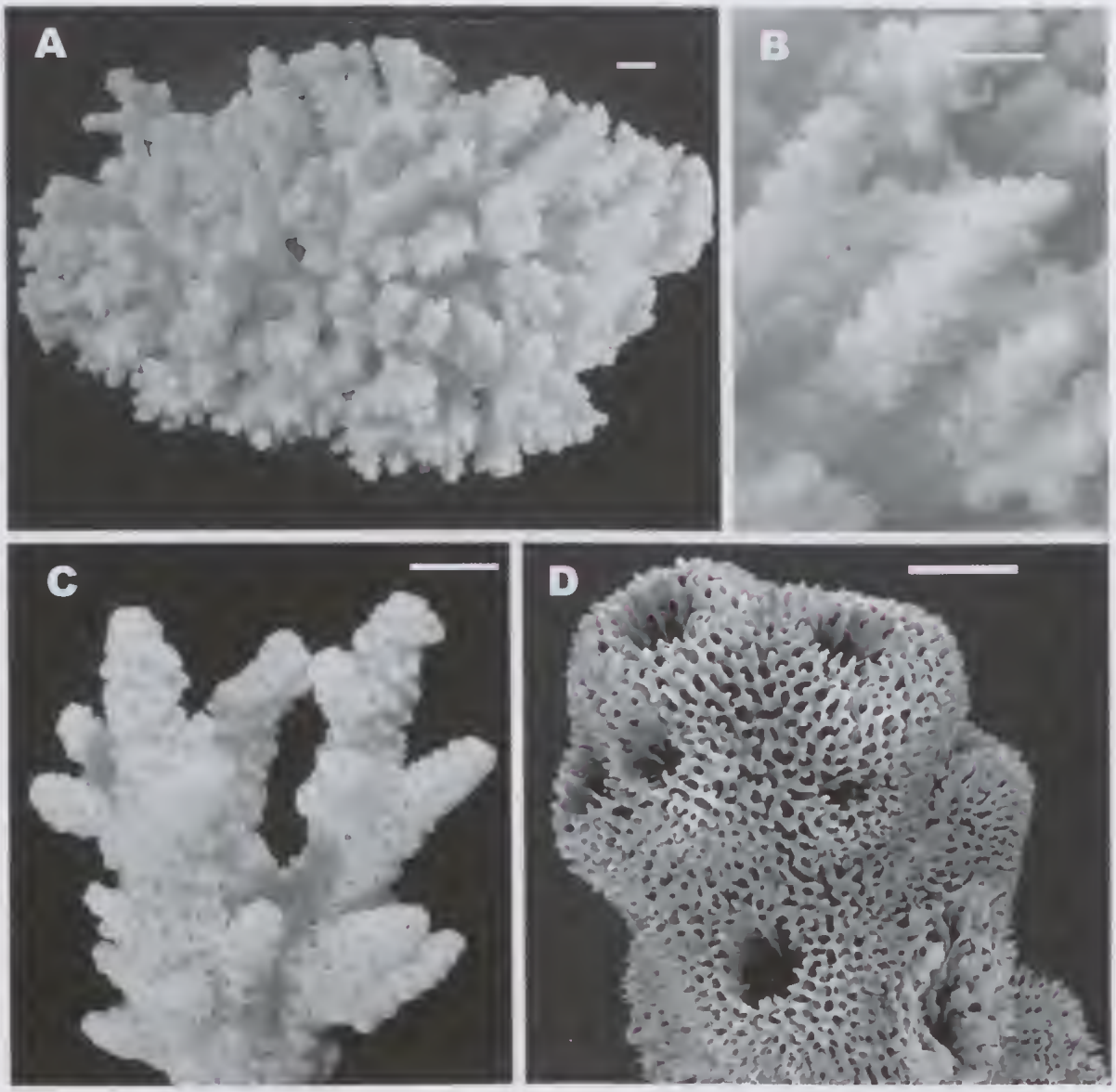

FIG. 17. *Acropora verweyi*: A, B, from Myora (MTQ-G57828); C, D, from Myora (MTQ-G57486). A, whole colony. B, close-up of part of colony. C, portion of a colony. D, scanning electron micrograph of branch tip. Scale bars: A, C = 10 mm; B = 5 mm; D = 1 mm.

dicates it has established in the bay since the 1974 flooding. It is exclusively intertidal throughout its distribution, including its Moreton Bay colonies on the shallow Myora reef flat. *Acropora verweyi* has been used experimentally to show a positive effect of increased temperature and light on strontium intake and skeletal extension (Reynaud *et al.* 2004); it could similarly be used to study changing conditions within the bay.

Further Literature. Harrison & Veron (1993); Wallace (1999); Reynaud *et al.* (2004).

The *Acropora selago* Group

Acropora donei Veron & Wallace, 1984 (Figs 3F, 18)

Acropora donei Veron & Wallace, 1984: 286–289, figs 698–709. [Type locality: Turtle Islands, Great Barrier Reef].

Material Examined. HOLOTYPE: MTQ-G55080, Turtle Islands, Great Barrier Reef. *Living Moreton Bay*: MTQ-G60059, Myora, CCW, PRM, 2007. *Living outside Bay*: MTQ-G56607, G58500, Shag Rock, S. Banks, 2003; G58414, G58423, Shag Rock, CCW, IF, PRM, 2005; G60060, Shag Rock, CCW, PRM, 2007; G27124, Flinders Reef, AIMS, pre 1984.

Skeletal Characteristics. Corallum usually an arborescent table, with a stalk, followed by main branches extending horizontally and secondary branches extending vertically from these. Branches terete, 6–1 5 mm in diameter and up to 10 mm long. Axial corallites outer diameter 2.0–4.2 mm, inner diameter 0.8–1.4 mm; radial corallites evenly sized and distributed, not touching, cochleariform but with lip reduced and extending directly otuwards from branch. Coenosteum lines of simple spinules on radial corallites, reticulate with scattered simple spinules in intercorallite areas.

Field Characteristics. Colonies are tables or side-attached plates, up to about 800 mm diameter in the Moreton Bay region. Colour grey, grey-blue, cream or white.

Distribution. Indo-Pacific from Seychelles and Red Sea to Marshall Islands. East Australia: Great Barrier Reef south to Moreton Bay region.

Remarks. The one living colony of *A. donei* found inside the bay was not fully developed, but this species occurs abundantly at Shag Rock outside the bay, and the description covers these specimens.

Further Literature. Wallace & Wolstenholme (1998); Wallace (1999); Veron (2000).

The *Acropora hyacinthus* Group

Diagnosis. Species with radial corallites evenly sized, labellate, the upper part of the wall being absent and the lower part being developed into a rectangular lip; coenosteum reticulate with simple spinules between radial corallites and costate on radial corallites. All species form tabular or plate colonies when mature.

Acropora hyacinthus (Dana, 1846) (Figs 3G, 19)

Madrepora hyacinthus Dana, 1846: 444, pl. 32, fig. 2. [Type Locality: Fiji].

Madrepora surculosa Dana, 1846: 445, pl. 32, figs 4–4a,5

Madrepora patella Studer, 1878: 526, pl. 1, fig. 1a, b, c

Madrepora turbinata Dana, 1846: what page number? Verrill, 1902: 242

Madrepora conferta Quelch, 1886: 164, pl. 10, fig. 3

Madrepora pectinata Brook, 1892: 460; 1893: 95, pl. 27, figs D–E

Madrepora recumbens Brook, 1892: 461; 1893: 106, pl. 27, fig. F

Madrepora sinensis Brook, 1893: 114, pl. 33, fig. C

Material Examined. HOLOTYPE: USNM-246, Fiji; *Living Moreton Bay*: MTQ-G57489–92, Myora, CCW, IF, PRM, 2003; MTQ-G60061, G60063–67, G60070–71, Moreton Bay, CCW, PRM, 2007. *Fossil Moreton Bay*: recorded as subfossil from Mud Island by Wells (1955). *Living outside Bay*: MTQ-G27596, G27599, G27602, G27617, Flinders Reef, AIMS, pre 1984; MTQ-G58433, Flat Rock, CCW, IF, PRM, 2005; MTQ-G60068–69, G60089, Shag Rock, CCW, PRM, 2007; MTQ-G27588, G27591, G27596–97, G27599, G27602, G27617, Flinders Reef, AIMS pre 1984. QM-G7298, G7359, Flinders Reef, E. Lovell, 1973; Flinders Reef, visual record CCW, IF, 2005. *Further south*: recorded to S.W. Rocks (Harriott *et al.* 1999).

Skeletal Characteristics. Corallum tabular to plate-like, capable of reaching over 3 m in diameter, the table-top consisting of horizontal branches from which extend single vertical branchlets 3–7 mm in diameter and up to 20

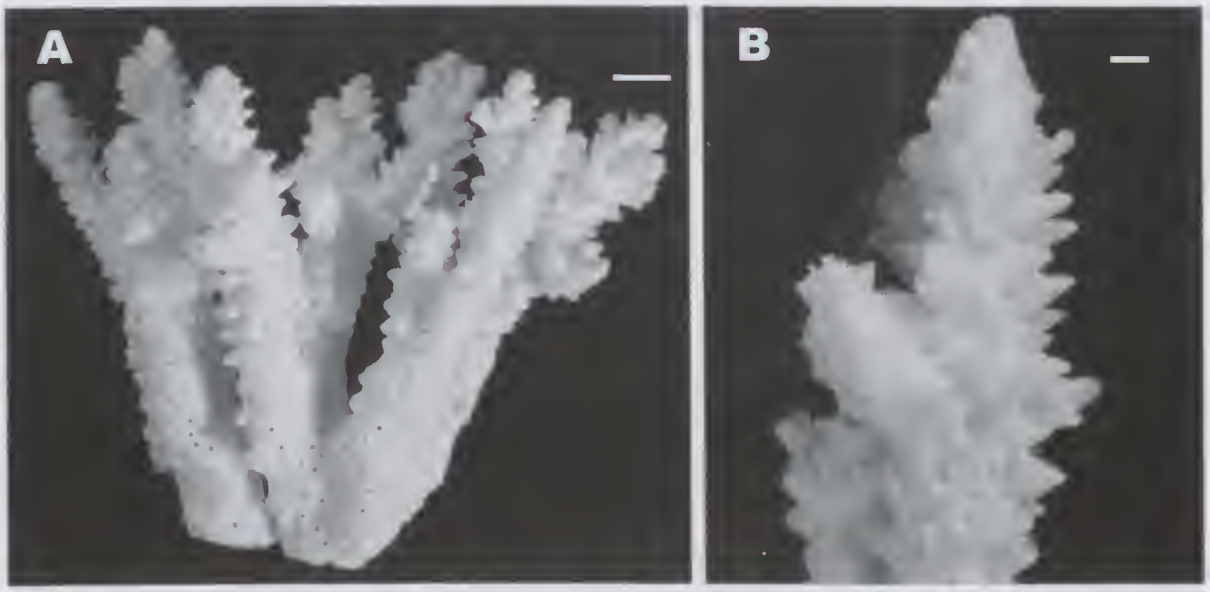

FIG. 18. *Acropora donei* from Myora (MTQ-G60059). A, portion of colony. B, detail of branch. Scale bars: A = 10 mm; B = 1 mm.

mm long. Axial corallites outer diameter 1.0–2.0 mm, inner diameter 0.4–1.1 mm; radial corallites evenly sized, touching, labellate, the lower wall developed as a rounded or square lip which extends outward from the branch; from above the radials can be seen to be arranged in a neat rosette around the axial. Coenosteum costate on radial corallites, reticulate with scattered laterally flattened spinules in intercorallite areas.

Field Characteristics. Mature colonies are tabular, but juveniles are firstly corymbose, up to a diameter of about 10 mm. Colonies in Moreton Bay are mostly bluish or pinkish brown.

Distribution. Widespread Indo-Pacific from East Africa and Red Sea to Pitcairn Islands. East Australia: Great Barrier Reef south to Solitary Islands, NSW, and Lord Howe Island.

Remarks. This species was not reported amongst living Moreton Bay corals prior to 2003, suggesting that it is a new arrival in the bay. All living colonies found before 2007 were small juveniles, but by 2007 numerous colonies up to 400 mm diameter were found, suggesting recuitment from around 2002.

Further Literature. Wallace (1978, 1999); Veron & Wallace (1984); Harriott *et al.* (1994, 1995, 1999); Veron (2000); Wilson & Harrison (2003).

The *Acropora latistella* Group

Diagnosis. Species with radial corallites evenly sized, appressed tubular with round openings, coenosteum throughout reticulate with well spaced, simple spinules. Colonies corymbose with slender branches in which radial corallites contribute approximatly half the branch diameter.

Acropora latistella (Brook, 1892) (Fig. 20)

Madrepora latistella Brook, 1892: 459; 1893: 112, pl. 9, fig. B. [Type locality: Great Barrier Reef].
Madrepora patula Brook, 1892: 460; 1893: 111, pl. 9, fig. E.
Acropora loricata Nemenzo, 1967: 113, pl. 32, figs 1–2.
Acropora imperfecta Nemenzo, 1971: 153, pl. 4, fig. 3.

Material Examined. LECTOTYPE: NHM-1892.6.8.275, Port Denison, Great Barrier Reef. *Living Moreton Bay*: MTQ-G56541, Myora, IF, 2002; MTQ-G35802, Empire Point, PLH, 1991. *Living outside Bay*: MTQ-G60062, Flat Rock, CCW, PRM, 2007; MTQ-G30599, Flinders

Reef, AIMS, pre 1984; Flinders Reef, visual record CCW, 2005.

Skeletal Characteristics. Corallum caespitocorymbose, with terete branches 4–8 mm in diameter and up to 40 mm long. Axial corallites outer diameter 1.0–2.0 mm, inner diameter 0.4–1.1 mm; radial corallites evenly sized and mostly separate on branch, appressed tubular with round to slightly oval or dimidiate openings. Coenosteum lines of simple spinules throughout.

Field Characteristics. The colony collected from Myora Reef was 100 mm in diameter and a pale blue-brown in colour.

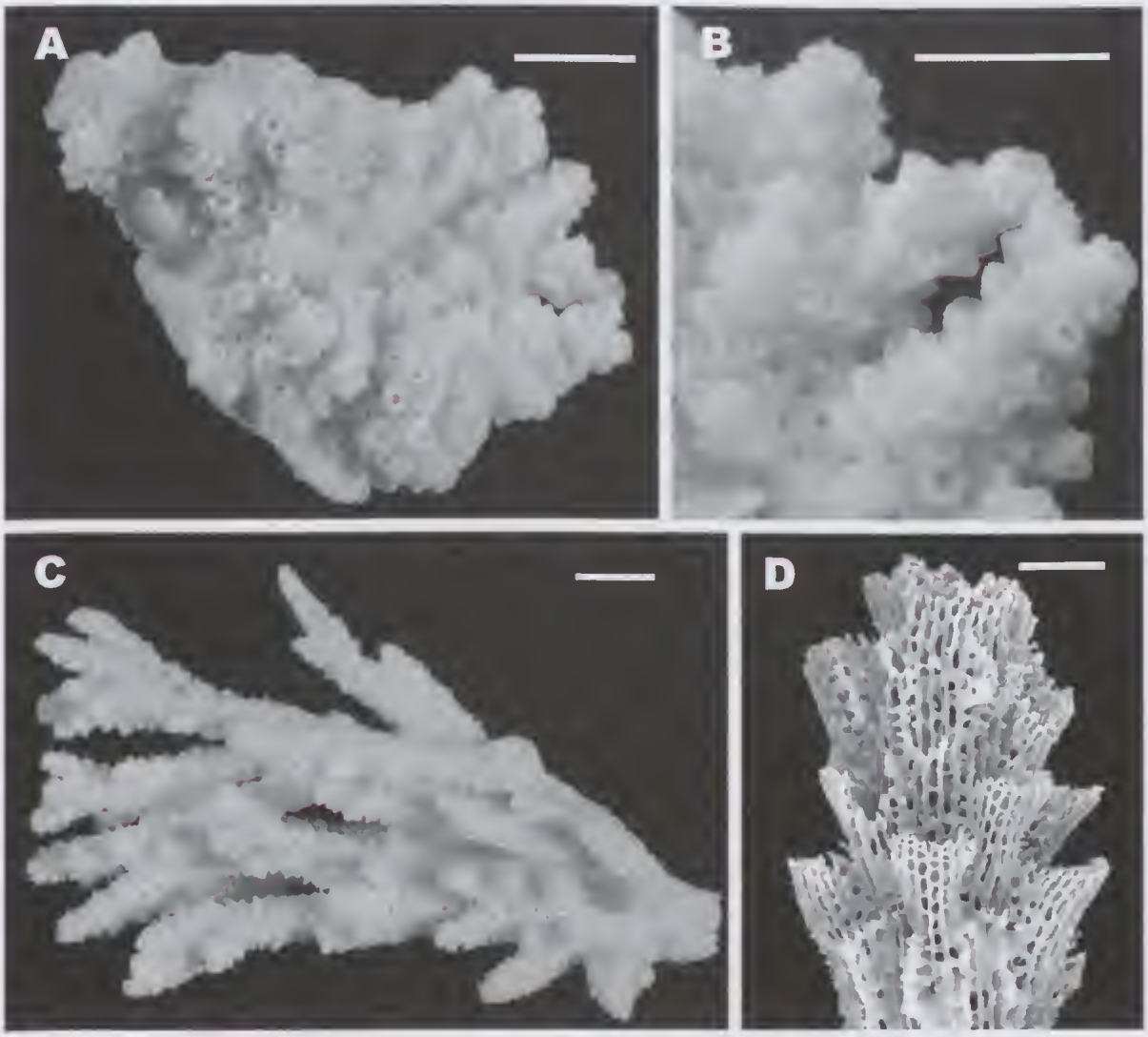

FIG. 19. *Acropora hyacinthus*: A, B, from Myora (MTQ-G57489); C, D, from Myora (MTQ-G57490). A, C, portion of colony. B, close-up of branches. D, scanning electron micrograph of branch tip. Scale bars: A, C = 10 mm; B = 5 mm; D = 1 mm.

Distribution. Widespread Indo-Pacific from East Africa and the Red Sea to Pitcairn Islands. East Australia: Great Barrier Reef south to Lord Howe Island.

Remarks. This is the first record for this species inside the bay.

Further Literature. Wallace (1978, 1999); Veron & Wallace (1984); Hayashibara *et al.* (1993); Harriott *et al.* (1995); Wallace & Wolstenholme (1998); Veron (2000).

Astreopora de Blainville, 1830

Type species. *Astrea myriophthalma* Lamarck, 1816.

Diagnosis. Colonies massive, subramose, plate-like or encrusting, coenosteum reticular, formed by outwardly inclined trabeculae, with spinose surface. Dissepiments tabular. Corallite walls solid. Upper Cretaceous to Recent.

Remarks. *Astreopora moretonensis* Veron & Wallace 1984, has not been recorded live from Moreton Bay but subfossil specimens from Mud Island, recorded by Wells (1955) as *Astreopora incrustans* Bernard, 1896, were attributed to *A. moretonensis* by Veron & Wallace (1984). Wells' subfossil specimens have not been located.

Astreopora listeri Bernard, 1896
(Fig. 21)

Astreopora listeri Bernard, 1896: 91–92, pl. 28, 29, 33, fig. 12. [Type locality: Tonga].
Astreopora hirsuta Bernard, 1896: 94, pl. 33, fig. 13.

Material Examined. *Living Moreton Bay*: MTQ-G58463, Goat I., PLH, IF, 2005. *Living outside Bay*: Flinders Reef recorded by Veron (1993).

Skeletal Characteristics. Corallum massive, up to 160 mm in diameter in specimen recorded, with some encrusting growth on one edge. Corallites rounded, immersed and sometimes surrounded by some wall (high spinules bound together by synapticular growth), which may be more developed on the outermost side. Calice diameters up to 2.1 mm; mature corallites with two full cycles of subequal septa. Coenosteum reticulate, with evenly distributed long spinules with branched ('feathered') tips; around the corallites, these extend outwards and upwards.

Field Characteristics. The single specimen recorded is hemispherical and pale lavender-blue in colour(a typical *Astreopora* colouration).

Distribution. Indo-Pacific from East Africa and the Red Sea to Eastern Australia to the central Pacific. East Australia: Great Barrier Reef to Moreton Bay region.

Remarks. This species was only recorded from Goat Island in 2005, and this specimen is, to our knowledge, the only living specimen of *Astreopora* ever recorded from inside Moreton Bay.

Further Literature. Wells (1955); Veron & Wallace (1984); Veron (2000).

Suborder FUNGIINA Verrill, 1865

Diagnosis. Solitary and colonial corals; fenestrate septa, formed by simple or compound trabeculae united by simple or compound synapticulae, margins beaded or dentate. *Mid-Triassic to Recent.*

SIDERASTREIDAE Vaughan & Wells, 1943

Diagnosis. Colonial, hermatypic. Colonies massive, columnar, ramose, foliaceous or laminar, colony formation by intra-or extratentacular budding. Synapticulothecate. Septa composed of one fan system or small, simple or compound trabeculae, laterally strongly granulated, more or less porous, margins beaded or dentate, laterally united by simple synapticulae. Corallites united by septo-costae, of which some primaries and secondaries may be united in species-specific patterns. Columella composed of one or more papillary trabeculae. Endothecal dissepiments present. *Cretaceous to Recent.*

Psammocora Dana, 1846

Type species. *Psammocora obtusangula* Dana, 1846.

Diagnosis. Massive, foliaceous, ramose, columnar or encrusting colonies. Corallites small and shallow, separated by ramifying, uniting septocostae. Columella a single trabecular pillar.

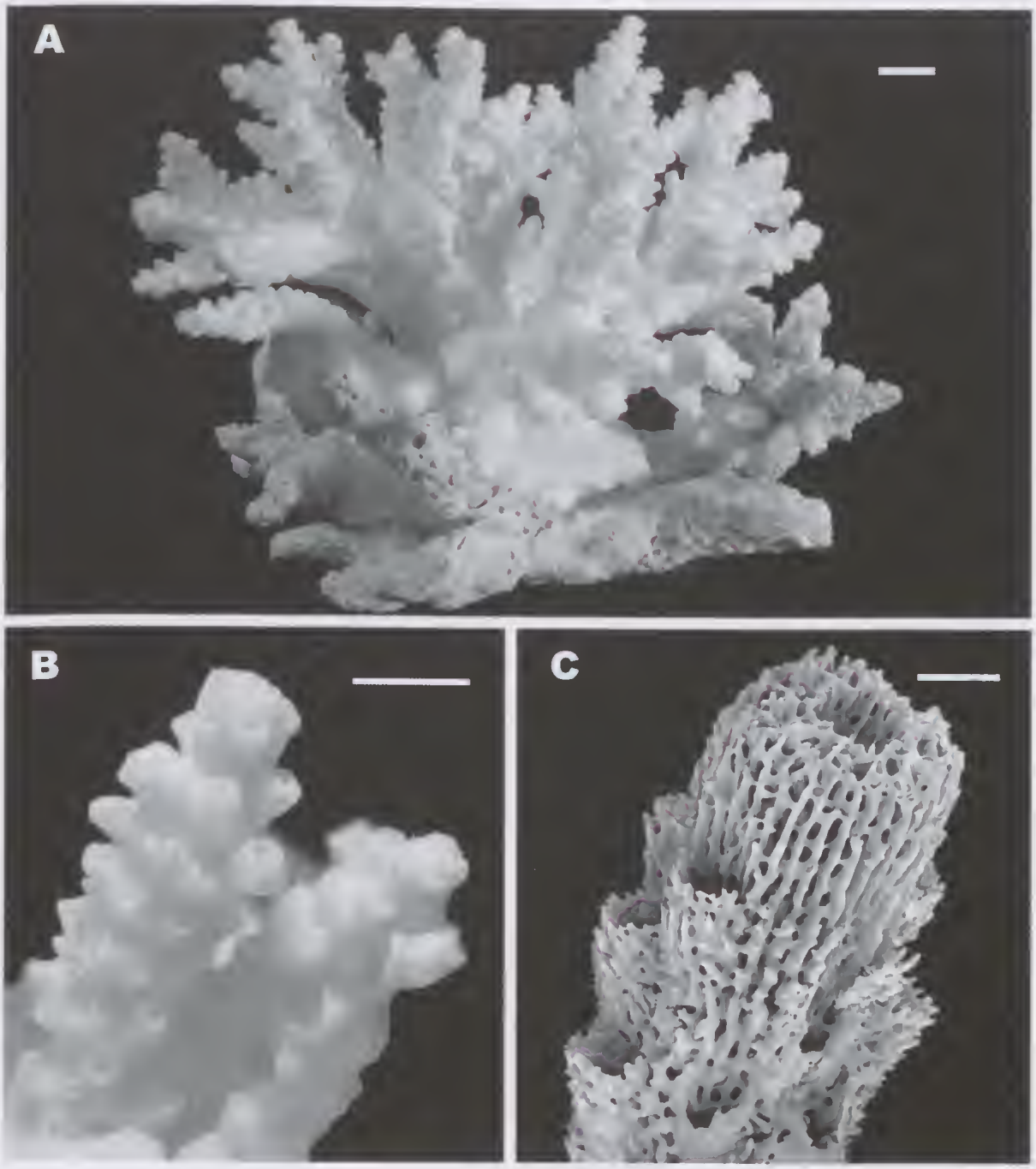

FIG. 20. *Acropora latistella*: A, B, from Myora (MTQ-G56541). A, whole colony. B, close-up of branches. C, scanning electron micrograph of branch tip. Scale bars: A = 10 mm; B = 5 mm; C = 1 mm.

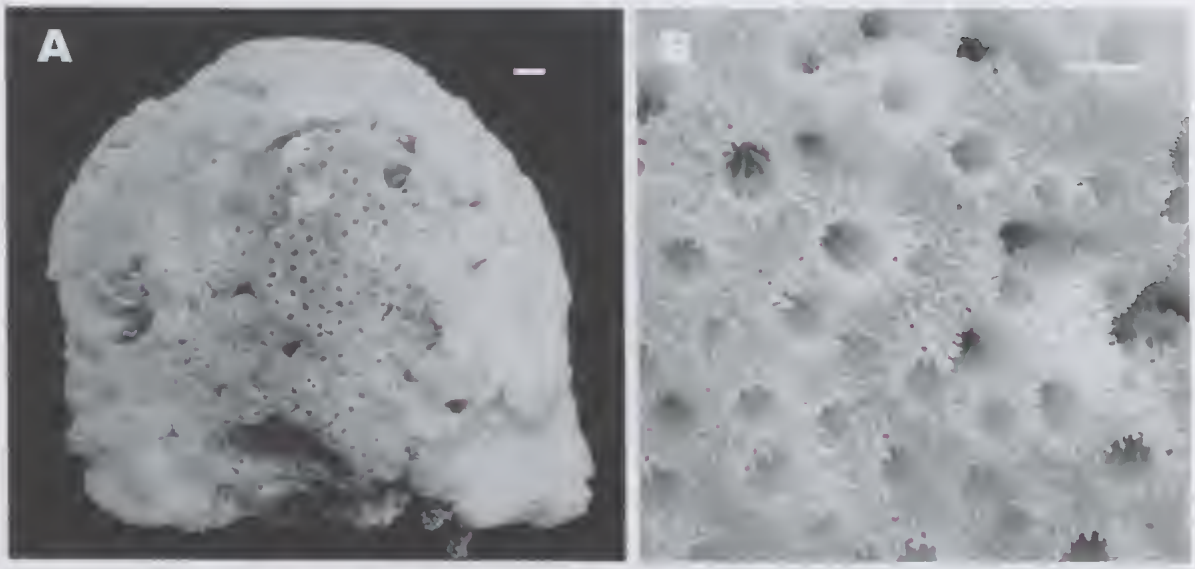

FIG. 21. *Astreopora listeri* from Goat Island (MTQ-G58463). A, whole colony. B, close-up. Scale bars: A = 10 mm; B, 2 mm.

Collines (coenosteal ridges) low and rounded, enclosing several centres or series of centres. *Miocene to Recent.*

Remarks. This genus was transferred from Thamnasteriidae to Siderastreidae by Veron (1986: 70) on the basis of a long-standing dilemma about the placement of family Thamnastereidae (summarised by Veron & Pichon, 1976: 21). *Psammocora* is easy to recognise because it is the only genus in the bay with very tiny, superficial corallites, however individual species may be difficult to separate in the field. Interpretation of species follows the revision of Benzoni (2006, 2007), and Stefani *et al.* (2008).

Psammocora superficialis Gardiner, 1898 (Figs 4A, 22A–B)

Psammocora superficialis Gardiner, 1898: 537, pl. 45, fig. 2. [Type locality: Funafuti (Pacific Ocean)].

Material Examined. *Living Moreton Bay*: QM-G5895, Green I., M. Dredge, 1971; MTQ-G57800, Peel I., PLH, 1994; QM-G8599, Peel I., E. Lovell, 1973; MTQ-G56586, Peel I., CCW, IF, PRM, 2003; MTQ-G57801–02, Wellington Point, PLH, 1991; MTQ-G57803, Green I., PLH, 1991; MTQ-G57799–800, Peel I., PLH, 1994. *Fossil Moreton Bay*: MTQ-G58662, Mud I., CCW, IF, PRM, 2003. *Living outside Bay*: QM-G7279, E. Lovell, Flinders Reef, 1973; sight record CCW, 2005.

Skeletal Characteristics. Corallum thick encrusting to massive, with irregular lobes formed in massive colonies. Development of surface ridges variable, and colonies may be completely smooth, with ridges completely flattened. Corallites mostly scattered evenly on the surface of the colony, occasionally in series; Mature calices 1.1–2.4 mm in diameter. Up to 24 septa are present, but adjacent pairs may fuse to varying degrees, in a 'petaloid' pattern, as noted in many descriptions, so that only 6–12 septa reach the centre of the corallite. Coenosteum collines formed of septo-costae form ridges or flattened ridges between corallites.

Field Characteristics. Small colonies may be encrusting but most colonies are domed to irregular and grey or grey-brown in colour.

Distribution. Widespread: Indo-Pacific from East Africa, Red Sea and Arabian Gulf, across to western Colombia. East Australia: Great Barrier Reef South to South West Rocks, northern NSW.

Remarks. Roberts & Harriott (2003) made the remarkable discovery that two living colonies

of *P. superficialis* from Green Island. were an estimated 220 and 270 years old, pre-dating European settlement of Brisbane. They used this species to study growth rates as well as bioluminescence due to flood effects at Peel Island and Wellington Point.

Further Literature. Veron & Pichon (1976); Roberts & Harriott (2003); Harriot *et al.* (1994); Banks & Harriott (1995); Veron (2000); Benzoni (2007).

Psammocora albopicta Benzoni, 2006 (Fig. 22C, D)

Psammocora albopicta Benzoni, 2006: 51–56, figs 1–4. [Type locality: Kuwait, Arabian Gulf].

Material Examined. *Living Moreton Bay*: MTQ-G57801, Wellington Point, PLH, 1991; MSNM-336, Moreton Bay, Wallace, 2005.

Skeletal Characteristics. Corallum encrusting. Mature calices 0.1 to 1.0 mm in diameter. For other features see Benzoni (2006).

Field Characteristics. Encrusting colonies with a smooth surface, due to the very small corallites, but the overall shape determined by the underlying substrate. Colour grey-brown.

Distribution. Scattered records from the Arabian Gulf and Gulf of Aden to Australia and Japan, but presumably more evenly spread. East Australia: from Hervey Bay in SE Queensland south to Julian Rocks, NSW.

Remarks. As Benzoni (2006) notes, this species has usually been identified as *Psammocora superficialis* and this was the case also in Moreton Bay, leading up to the preparation of this manuscript. The specimen from Wellington Point was recognised as *P. albopicta* by Benzoni (2006).

Further Literature. Harrison *et al.* (1991, 1998); Veron (2000); Roberts & Harriott (2003).

Psammocora profundacella Gardiner, 1898 (Figs 4B, 23A–B)

Psammocora profundacella Gardiner, 1898: 537, pl. 45, fig. 3. [Type locality: Funafuti (Pacific Ocean)].

Material Examined. *Living Moreton Bay*: MTQ-G56517, Green I., IF, 2001; MTQ-G58485, Goat I., CCW, IF, PRM, 2005; MTQ-G60181–82, Goat I., CCW, PRM, 2007. *Further south*: MTQ-G35073, Solitary Is, AIMS, 1978–1984.

Skeletal Characteristics. Corallum massive, irregular in outline, with nodular projections from the surface. Corallites single or arranged in groups surrounded by ridges. Mature calices 2.0 to 3.2 mm in diameter in Moreton Bay specimens. Up to 24 septa are present; little or no petaloid development. Coenosteum collines formed of septo-costae form ridges or flattened ridges between corallites.

Field Characteristics. Colonies are domed with irregular nodules over the surface,

Distribution. Widespread Indo-Pacific from East Africa, Red Sea to Pitcairn Islands. East Australia: Great Barrier Reef south to Moreton Bay region.

Remarks. Because it was thought that all specimens in the bay were the same species, very little collecting was done of *Psammocora*. *Psammocora profundacella* and *P. superficialis* are very difficult to separate in the field, at least in Moreton Bay where visibility is poor. Neither species has strong ridge development, but *P. superficialis* usually has a partially or completely smooth surface.

Further Literature. Veron & Pichon (1976); Veron (2000); Benzoni (2007).

Psammocora contigua (Esper, 1797) (Figs 23C–D)

Madrepora contigua Esper, 1794: L12, pl. 16, figs 1–4. [Type locality: Indo-Pacific].
Madrepora phyrigiana Esper, 1798: FL9, pl. 84, figs 1–3.
Pavonia obtusangula Lamarck, 1816: 240, pl. 2.
Psammocora plicata Dana, 1846: 346, pl. 25, figs 2–2(a,b).
Psammocora gonangra Klunzinger, 1879: 80–81, pl. 9, fig. 1.
Psammocora ramosa Quelch, 1886: 128–129, pl. 6, figs 6, 6b.
Psammocora decussata Yabe and Sugiyama 1937: 427, figs 2–4.
[synonymy after Stefani *et al.* 2008]

Material Examined. *Living Moreton Bay*: MTQ G55324–25, Peel I., PLH, 1991. *Living outside Bay*: Flinders Reef, recorded Veron (1993). *Further south*: recorded to Cook I. (Harriott *et al.* 1999).

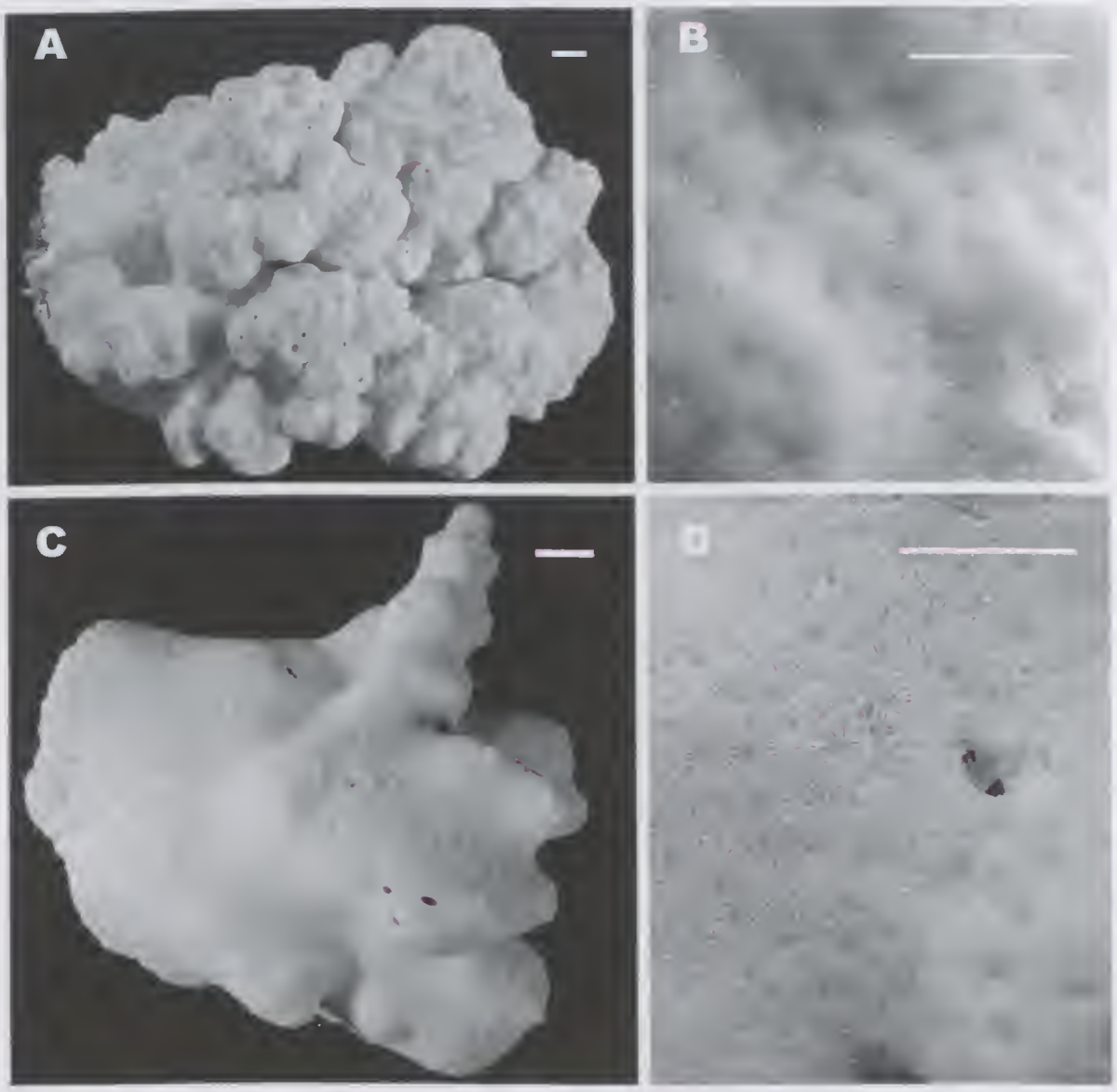

FIG. 22. A, B, *Psammocora superficialis* from Peel Island (MTQ-G56586). C, D, *Psammocora albopicta* from Green Island (MTQ-G57803). A, C, portion of colony. B, D, close-up of specimen. Scale bars: A, C = 50 mm; B, D = 5 mm.

Skeletal Characteristics. Corallum semi-encrusting, with short branches with acute tips. Corallites superficial, mature calices 2.0 to 3.5 mm in diameter in Moreton Bay specimens. Septa 14–18 are present; all reaching centre of corallite, sometimes combining with another septum just before this. Septa with elaborate granulations. Columella one to three small elements. (See Stefani *et al.* 2008 for full description of this species).

Field Characteristics. The only specimens found were small, with low branching growth.

Distribution. Widespread Indo-Pacific from East Africa, Red Sea and Arabian Gulf to French Polynesia. East Australia: Great Barrier Reef south to Cook Island, northern NSW, and Lord Howe Island (Harriott *et al.* 1995).

Remarks. Previous publications have cited the presence of *Psammocora contigua* in Moreton

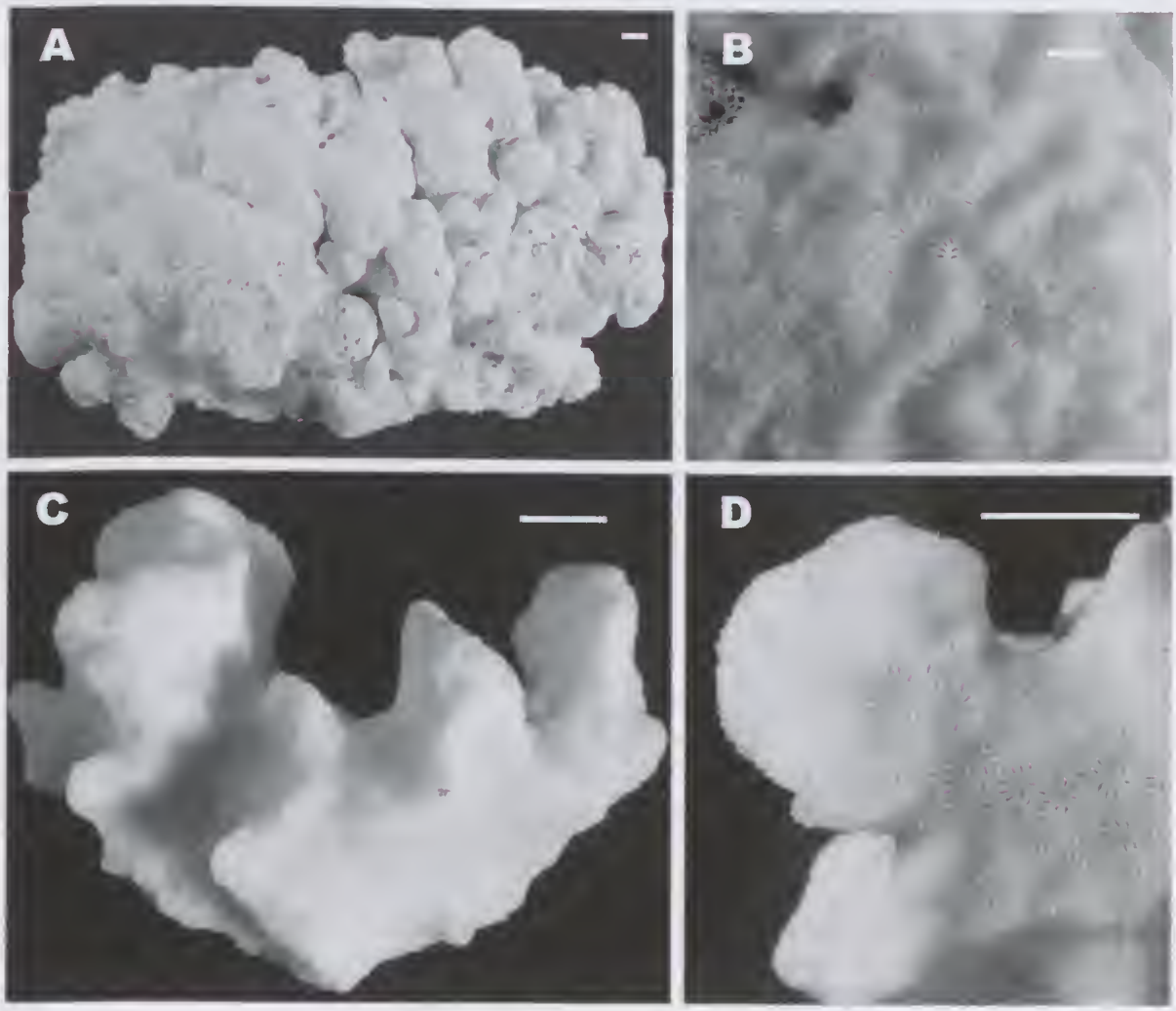

FIG. 23. A, B, *Psammocora profundacella* from Green Island (MTQ-G56517). A, whole colony. B, close-up of specimen. C, D, *Psammocora contigua* from Peel Island (MTQ-G55325). Scale bars: A, C = 10 mm; B = 5 mm; D = 1 mm.

Bay but it appears that this species may always have been rare in the bay and other species may have been confused with *P. contigua*.

Further Literature. Lovell (1989); Harrison *et al.* (1991); Veron (2000); Benzoni (2007).

FUNGIIDAE Dana, 1846

Diagnosis. Solitary or colonial, fixed or free, mostly hermatypic, wall synapticulothecate, secondarily septothecal of thickened. Septa numerous, perforate or solid, composed of a single fan system of compound trabeculae, with simple or compound marginal dentations. Costae continuous or broken. Dissepiments absent. *Mid Cretaceous to Recent.*

Cycloseris Milne Edwards & Haime, 1849

Type species. *Fungia cyclolites* Lamarck, 1816

Diagnosis. Corallum circular or slightly oval, free, mostly monostomatous, generally smaller than *Fungia*, imperforate. *Mid Cretaceous to Recent.*

Remarks. Some authors (e.g. Veron 2000) treat this taxon as a distinct genus. The revision of Hoeksema (1989) is followed here.

Cycloseris cyclolites (Lamarck, 1815) (Fig. 24)

Fungia cyclolites Lamarck, 1815, 1816: 236. [Type locality: unknown].
Fongia cyclolites de Blainville, 1820: 216.
Fungia glans Dana, 1846: 290, pl. 18, fig. 2.
Diaseris wortoni Tenison-Woods, 1881: 460.
Fungia japonica Vaughan, 1906: 827, pl. 67, figs 1–4.
Fungia adrianae Van der Horst, 1921: 60, pl. 2, figs 6–7.
Fungia patelliformis Boschma, 1923: 136, pl. 9, figs 15–15a.
Fungia borneensis Gerth, 1925: 47.

Material Examined. *Living Moreton Bay*: QM-G7120 (nine specimens), off Peel I., T.H. & party, 1954 (mentioned in Wells, 1964); MTQ-G58395, Moreton Bay, dredged, M.Precker, 2005. *Further south*: recorded to southern NSW by Harriott *et al.* (1999).

Skeletal Characteristics. Free-living, domed and round to slightly oval in outline, irregular in specimens which are regenerating from fragments; diameter up to 150 mm. Septa densely packed, lower order cycles high, thick and solid, higher orders thinner, lower and mostly perforated; septal margins with small sharp granulations and septal sides granulated (see Hoeksema 1989 for detailed description). Undersurface with fine, numerous costae ornamented with small spines.

Field Characteristics. The specimens in the collection were dredged from 7 to 8.5 m. depth. Living animals pale brown.

Distribution. Indo-Pacific from central Indian Ocean to the Pitcairn Islands. East Australia: Great Barrier Reef to southern NSW (Harriott *et al.* 1999).

Remarks. We follow Hoeksema (1989) in maintaining this species as a subgenus of *Fungia*, as no characters other than colony diameter distinguish it from the other species in the genus.

Further Literature. Wells (1964); Hoeksema (1989); Harriott *et al.* (1999); Veron (2000) (as *Cycloseris cyclolites*).

PORITIDAE Gray, 1842

Diagnosis. Colonial, hermatypic. Colony formation by extratentacular budding. Corallites mostly united closely without coenosteum, limited by one or more synapticular rings. Septa (except in *Alveopora*) formed by 3 to 8 nearly vertical trabeculae, loosely united, with more or less regular perforations. Innermost trabeculae of certain septa differentiated as pali. A single columellar trabeculum. Mid Cretaceous to Recent.

Remarks. The only genus of this family known from the bay is *Goniopora*, although both *Porites* and *Alveopora* are found on the reefs outside the bay.

Goniopora de Blainville, 1830

Type species. *Goniopora pedunculata* Milne Edwards & Haime, 1849.

Diagnosis. Massive, columniform or ramose, rarely encrusting. Septa generally in three cycles, formed by four to eight trabeculae. The septal pattern of arrangement in *Goniopora* (as distinct

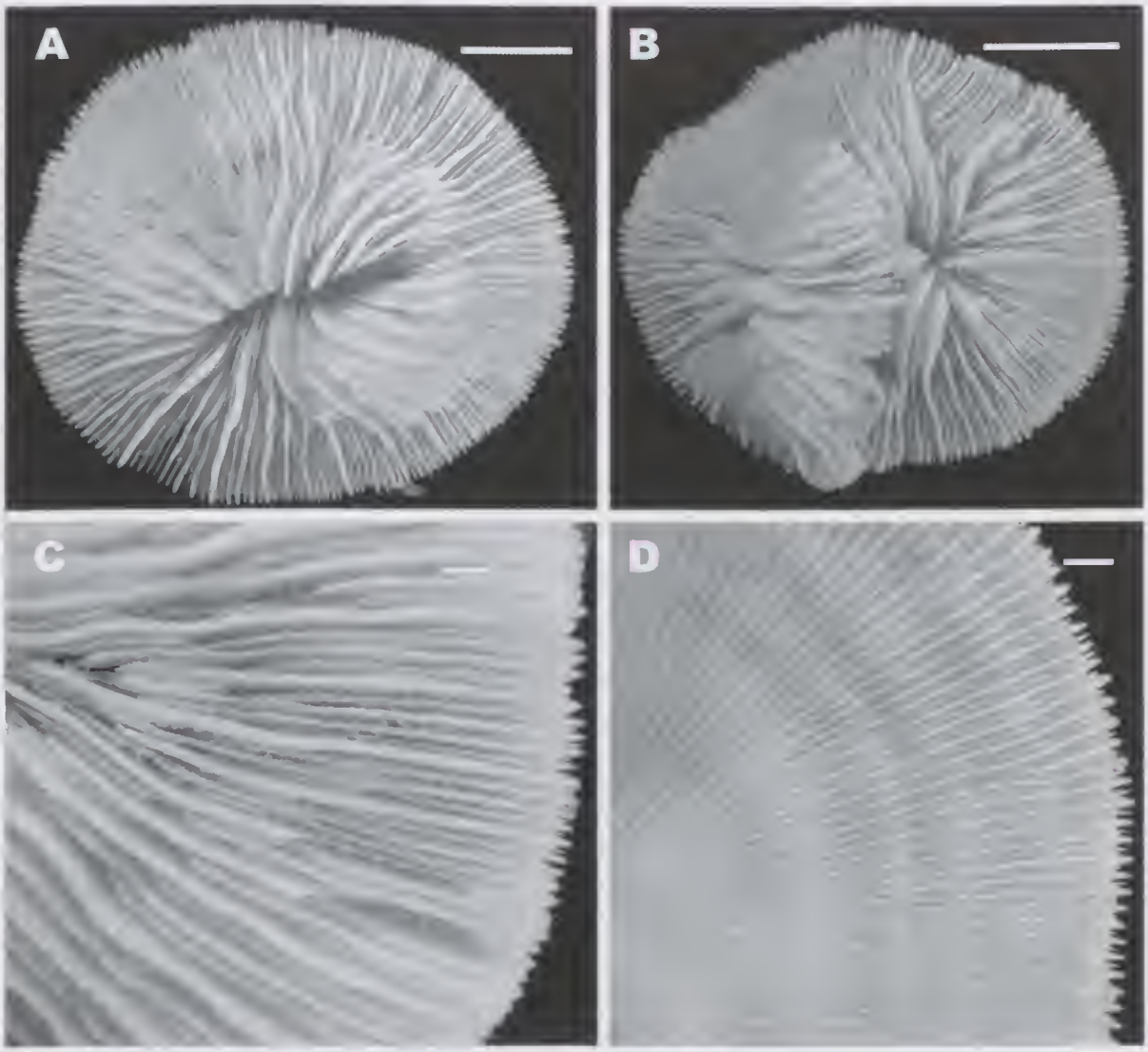

FIG. 24. *Fungia* (*Cycloseris*) *cyclolites* from Peel Island (QM-G7120). A, B, whole individuals. C, upper surface. D, under surface. Scale bars: A, B = 10 mm; C, D = 1 mm.

from *Porites*) is shown in Bernard (1905 p. 13) and Veron & Pichon (1982 p. 64). Polyps have 24 tentacles. Mid Cretaceous to Recent.

Remarks. This is one of the most diverse genera in the bay, being represented by at least five species. Most species of this genus have polyps which expand to a very large size in comparison with the corallite, and are expanded day and night except when the colony is disturbed. The easiest species to identify in the field are *G. stuchburyi* (with tiny corallites); *G. lobata* (with very large corallites), and *G. minor* (usually bright green, with teardrop shaped tentacles). Only *Goniopora stokesi* and *G. stutchburyi* have

been identified as present in bay collections prior to 1974, but perhaps this is simply a collecting artefact because all species except *G. tenuidens* have been found in the fossil assemblages.

Goniopora djiboutiensis Vaughan, 1907 (Figs 4C, 25)

Goniopora djiboutiensis Vaughan, 1907: 263, pl. 26, 27, fig 2. [Type locality: Somalia].

'*Goniopora* Great Barrier Reef 1' Bernard, 1903: 48, pl. 2, fig. 1, pl. 11, fig. 9.

Material Examined. HOLOTYPE (portion): USNM-21990, Indian Ocean, Gulf of Aden, Djibouti, 1904 (remainder of holotype in MNHN, Paris). *Living Moreton Bay*: MTQ-G57473, Peel I., IF, 2001; MTQ-G57813–14, G58667, Peel I., PLH, 1991; MTQ-G57809, Peel I., IF, 2004, G58663, G58886, Peel I., CCW, IF, PRM, 2005; MTQ-G58664–65, Green I., CCW, IF, PRM, 2003; MTQ-G58892, Green I., CCW, IF, PRM, 2005; MTQ-G60221, Goat I., CCW, PRM, 2007; MTQ-G57815, G58666, Wellington Point, PLH, 1991. *Fossil Moreton Bay*: MTQ-G58762–65, Empire Point, C.C.Wallace, IF, PRM, 2005. *Living outside Bay*: Flinders Reef, recorded Veron (1993); Flinders Reef, visual record CCW, 2005. *Further south*: recorded to Solitary Islands, NSW (Harriott *et al.*1995).

Skeletal Characteristics. Corallum sub-massive or short thick columns. Corallites diameter 3.0–5.2 mm; 24 septa in typical gonioporoid arrangement; short, uniform, and arranged in six groups of 4 fused with columella. Columella prominent, dome-shaped, occupying more than half the diameter of the calice, composed of concentrically arranged synapticula and fused inner ends of the septa; forming a series of six deltaic arrangements with septa. Polyps with long columns, large oral cones and medium tentacles.

Field Characteristics. Colonies rounded or semi columnar, with thick columnar branches; colour pale brown, grey or light green; polyps with medium long columns and tentacles, a single catch tentacle sometimes extended, oral cones white.

Distribution. Indo-Pacific from East Africa, Red Sea and Arabian Gulf to Fiji. East Australia: Great Barrier Reef south to Solitary Islands, NSW (Harriott *et al.*1995).

Remarks. This is a common species of *Goniopora* in the southern part of the bay.

Further Literature. Veron & Pichon (1982); Banks & Harriott (1995); Harriott *et al.* (1995); Veron (2000).

Goniopora lobata Milne Edwards & Haime, 1851 (Figs 4D, 26)

Goniopora lobata Milne Edwards & Haime, 1851: 40. [Type locality: Red Sea, see Milne Edwards (1860)].

Goniopora hirsuta Crossland, 1952: 233, pl. 48, figs 2, 4.

Goniopora traceyi Wells, 1954: 451, pl. 163, figs 6–8.

Material Examined. *Living Moreton Bay*: MTQ-G58789–90, Peel I., CCW, IF, PRM, 2005; MTQ-G57846, Green I., PLH, 1991; MTQ-G60215–16, Goat I., CCW, PRM, 2007. *Fossil Moreton Bay*: MTQ-G60217, Mud I., PRM, 2007; recorded as subfossil from Goat and Mud Islands by Wells (1955). *Living outside Bay*: Flinders Reef, recorded Veron (1993). *Further south*: recorded to Solitary Is (Harriott *et al.* 1995, 1999).

Skeletal Characteristics. Corallum hemispherical or lobate with short thick columns. Corallite calices 2.4–5.0 mm diameter, walls with regular circular pores due to synapticular links between septa; 24 septa, fused in gonioporoid pattern; no pali but paliform lobes may resemble pali. Columella usually just a few twisted dentations, but may be up to half calice diameter.

Field Characteristics. Polyps with medium length columns and short tentacles, white around mouth; colour brown or bright apple green.

Distribution. Indo-Pacific from East Africa, Red Sea and Arabian Gulf to Fiji. East Australia: Great Barrier Reef south to Solitary Islands, northern NSW (Harriott *et al.* 1995, 1999).

Further Literature. Veron & Pichon (1982); Lovell (1989); Veron (2000).

Goniopora minor Crossland, 1952 (Figs 4E, 27)

Goniopora minor Crossland, 1952: 233, pl. 48, figs 1, 3. [Type locality: Great Barrier Reef].

Goniopora pedunculata Quoy & Gaimard, 1833: 218–220, pl.16, figs 9–11.

'*Goniopora* Great Barrier Reef 5' Bernard, 1903: 52, pl. 2, fig. 6.

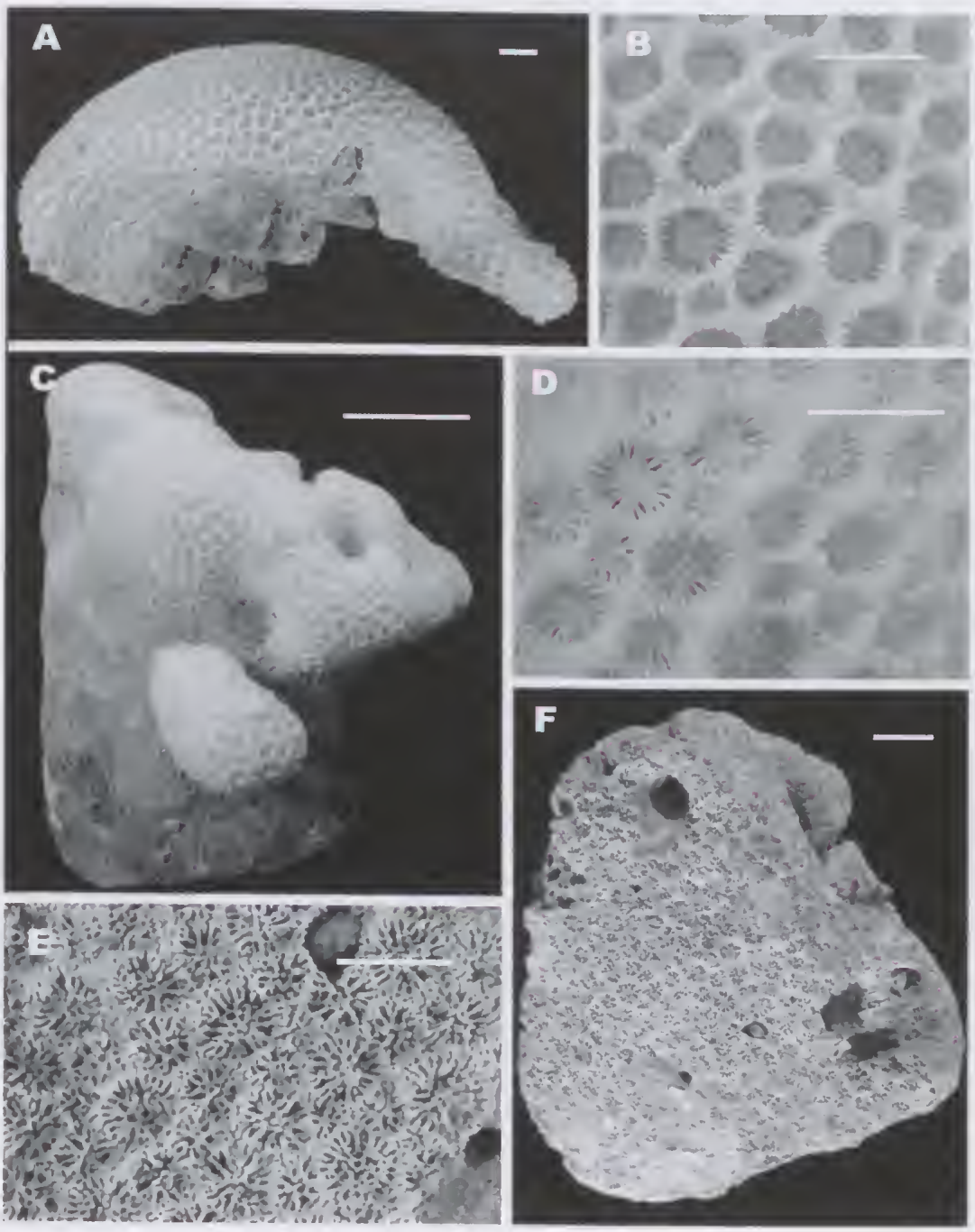

FIG. 25. *Goniopora djiboutiensis*: A, B, from Green Island (MTQ-G58664); C, D, from Peel Island (MTQ-G585663); E, F, fossil from Empire Point (MTQ-G58762). A, C, whole colony. B, D, close-up of part of colony. Scale bars: A, C = 50 mm; B, D, E = 5 mm; F = 10 mm.

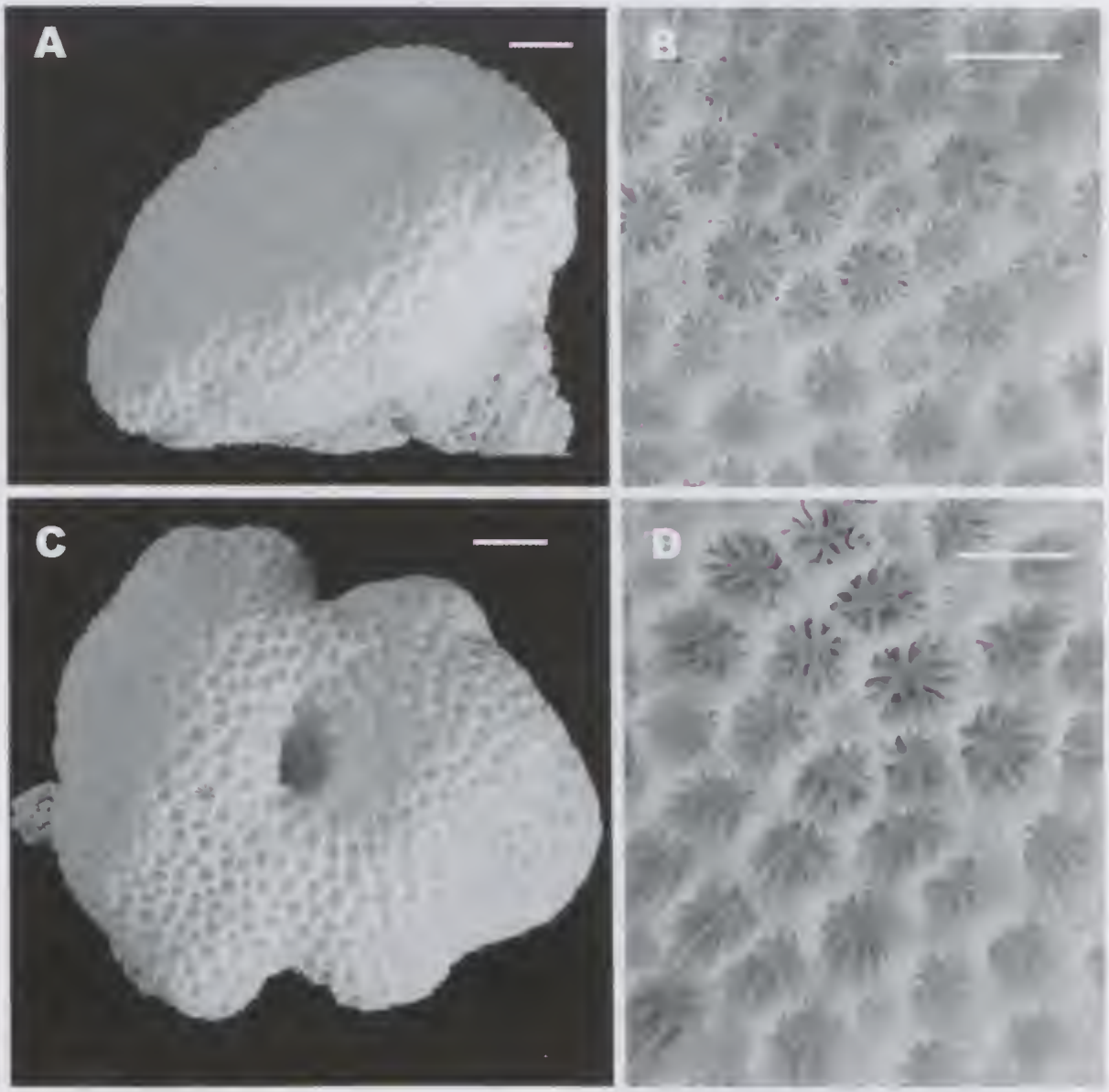

FIG. 26. *Goniopora lobata*: A, B, from Peel Island (MTQ-G56586); C, D, from Goat Island (MTQ-G57803); A, C, whole colony; B, D, close-up of part of colony. Scale bars: A, C = 10 mm; B, D = 5 mm.

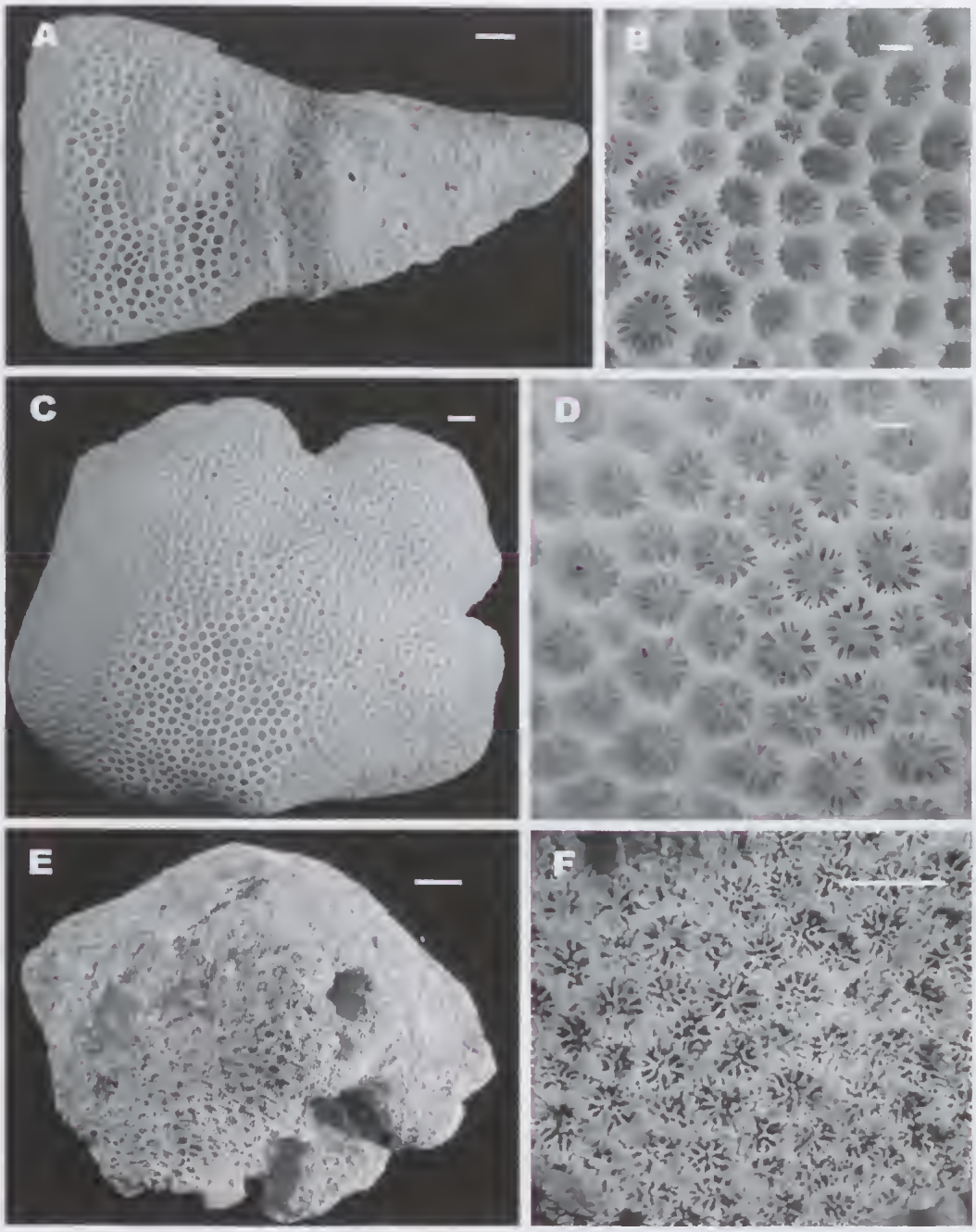

FIG. 27. *Goniopora minor*: A, B, from Empire Point (MTQ-G56615); C, D, from Empire Point (MTQ-G57474); E, F, (MTQ-G57471) fossil from Empire Point. A, C, E, whole colony. B, D, F, close-up of part of colony. Scale bars: A, C, E = 10 mm; B, D = 1 mm; F = 5 mm.

Material Examined. HOLOTYPE: NHM-GBR Expedition No. 56, Great Barrier Reef. *Living Moreton Bay*: MTQ-G57468, Peel I., CCW, IF, PRM, 2003; MTQ-G57839, G58891, Green I., PLH, 1991; MTQ-G58785–87, G58887–88, Peel I., CCW, IF, PRM, 2005; MTQ-G58889, Peel I., PLH, 1994;MTQ- G59241, Green I., CCW, IF, PRM, 2005; MTQ-G56615, G57469, G57474, Empire Point, IF, 2004; MTQ-G60222, Myora, CCW, PRM, 2007; MTQ-G58784, G59240, G59242, Moreton Bay, CCW, IF, PRM, 2005. *Fossil Moreton Bay*: MTQ-G57471, Empire Point, CCW, IF, PRM, 2003.

Skeletal Characteristics. Corallum hemispherical. Corallites 2.3–4.0 mm calice diameter, 'with walls up to 1.9mm thick' (Veron & Pichon 1982). Septa in three cycles, the first two almost equal; inner margins of first and second cycle septa fused with pali and pali fused with each other; six well-developed pali, forming a neat crown, pali and septa heavily granulated; septal teeth present and elaborated at tips. Columella absent or weakly developed, at most a few anastomosed septal dentations.

Field Characteristics. Polyps extended during day; column intermediate length, tentacles tear drop shaped, prominent, colour apple green.

Distribution. Indo-Pacific from East Africa, Red Sea and Arabian Gulf to French Polynesia. East Australia: Great Barrier Reef south to Moreton Bay region.

Remarks. The lack of a columella is distinctive for skeletal identification of this species. *Goniopora minor* is common throughout Moreton Bay.

Further Literature. Veron & Pichon (1982); Veron (2000).

Goniopora stokesi Milne Edwards & Haime, 1851 (Figs 4F, 28)

Goniopora stokesi Milne Edwards & Haime, 1851: 41. [Type locality: unknown].

Alveopora irregularis Crossland, 1952: 234, pl. 49, fig 2, pl. 50, fig. 1.

Material Examined. HOLOTYPE: MNHN-502 (177a), locality unknown (photographed F. Benzoni). *Living Moreton Bay*: MTQ-G58844, Peel I. CCW, IF, PRM, 2005; MTQ-G57810–11, Green I., PLH, 1991; MTQ-G56592, G57472, Green I., CCW, IF, PRM, 2003; MTQ-G58788, G58845, Green I., CCW, IF, PRM, 2005; MTQ-G58761, Goat I., CCW, IF, PRM, 2005; MTQ-G60218–19, Goat I., CCW, PRM, 2007; MTQ-G57812, G57845, G59218, Wellington Point, PLH, 1991; QM-Great Barrier Reef Committee 288, Peel I., C. Hedley, 1924; QM-G6978, Peel I., E. Lovell, 1972. *Fossil Moreton Bay*: MTQ-G56611–14, G57471, Empire Point, CCW, IF, PRM, 2003.

Skeletal Characteristics. Corallum hemispherical. Corallites calice diameter 3.0–4.8 mm. Septa 22–27, up to 12 reaching the columella, a further 12 reaching 1/2R, and the third barely visible, sometimes absent. Columella open trabecular, up to half corallite diameter, with star-shaped structure formed by extension of the six primary septa, some of which join up with secondary septa.

Field Characteristics. Colonies hemispherical or composed of short columns. Polyp columns in mixed sizes and tentacles medium length. Colour brown or green.

Distribution. East Australia: Great Barrier Reef to Solitary Islands, NSW.

Further Literature. Veron & Pichon (1982); Banks & Harriott (1995); Harriott *et al.* 1995; Veron (2000).

Goniopora tenuidens (Quelch, 1886) (Fig. 29)

Rhodaea tenuidens Quelch, 1886: 188, pl. 8, figs 7–7b. [Type locality: Santa Cruz Major I., off Samboangan, Philippines].

Material Examined. *Living Moreton Bay*: MTQ-G60220, Goat I., CCW, PRM, 2007.

Skeletal Characteristics. Corallum massive, hemispherical. Corallites calice diameter 2.4 – 3.1 mm. Septa 22–26, the second cycle prominent, thick, bearing thick pali and meeting at the columella; first and third cycles plunge deep into the corallite; all septa regularly dentate; tops of corallite walls contain pores formed by linked synapticulae. Columella formed by a few septal dentations.

Field Characteristics. Colonies brown with medium length tentacles and columns.

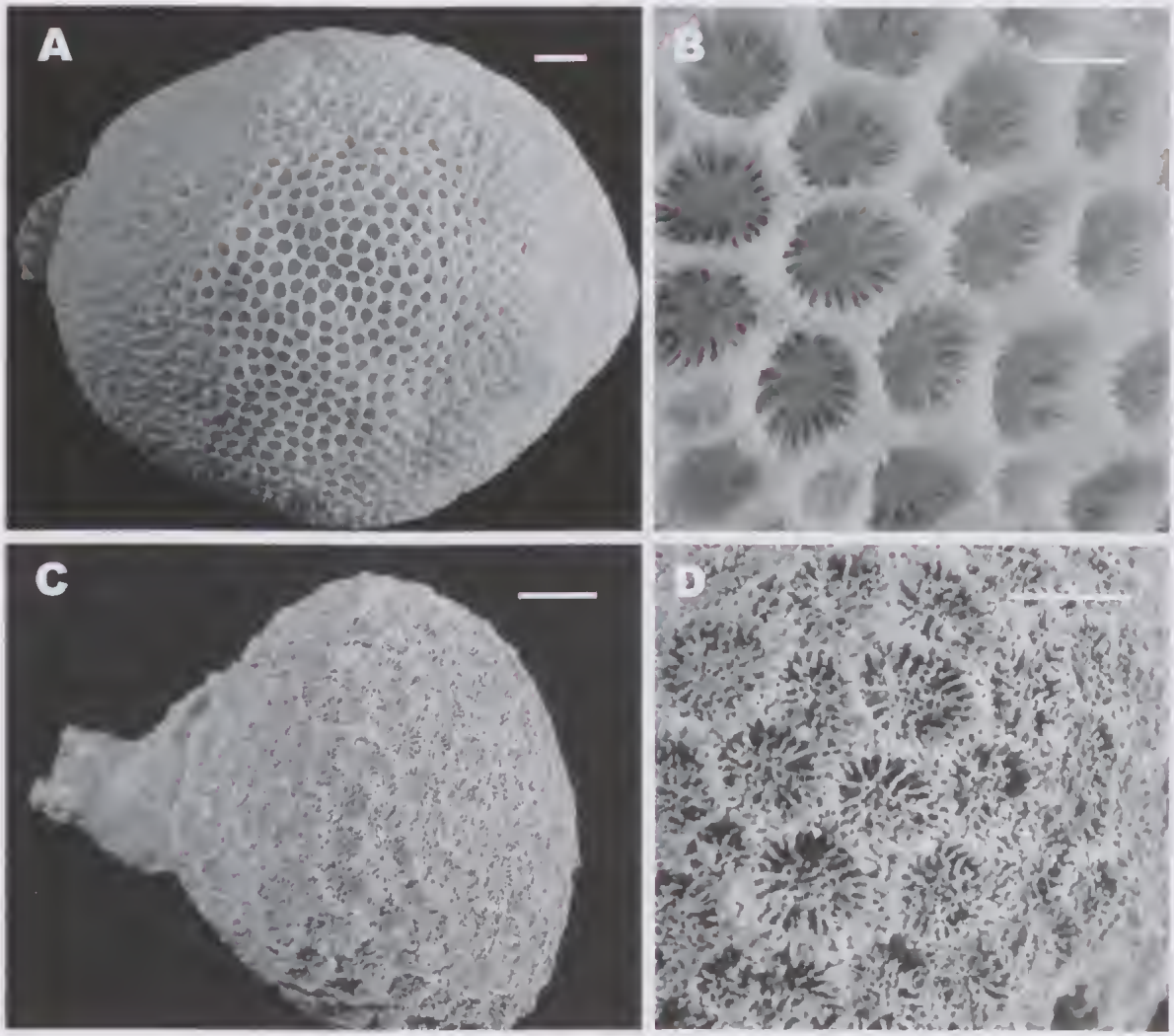

FIG. 28. *Goniopora stokesi*: A, B, from Peel Island (QM-GBR288); C, D, fossil from Empire Point (MTQ-G56613); A, C, whole colony; B, D, close-up of part of colony. Scale bars: A, B, C = 10 mm; D = 5 mm.

Distribution. Indo-Pacific from East Africa, Red Sea and Arabian Gulf to Fiji. East Australia: Great Barrier Reef south to Lord Howe Island, NSW.

Remarks. The star-like appearance of the thickened secondary septa are distinctive for this species.

Further Literature. Veron & Pichon (1982); (Harriott *et al.* 1995); Veron (2000).

Goniopora stutchuryi Wells, 1955
(Figs 4G, 30)

Goniopora stutchburyi Wells, 1955: 11, pl. 1, figs 1–2. [Type locality: Coppersmith Rock, Qld].

Goniopora nigra Pillai, 1967: 402, pl. 1, figs 1–2.

Goniopora wotouensis Zou, Song & Ma 1975: 241, pl. 1, fig. 4.

Material Examined. HOLOTYPE: QM-G2931, Coppersmith Rock, Qld, W. Stephenson and J.W. Wells. *Living Moreton Bay*: MTQ-G56535, Green I.,

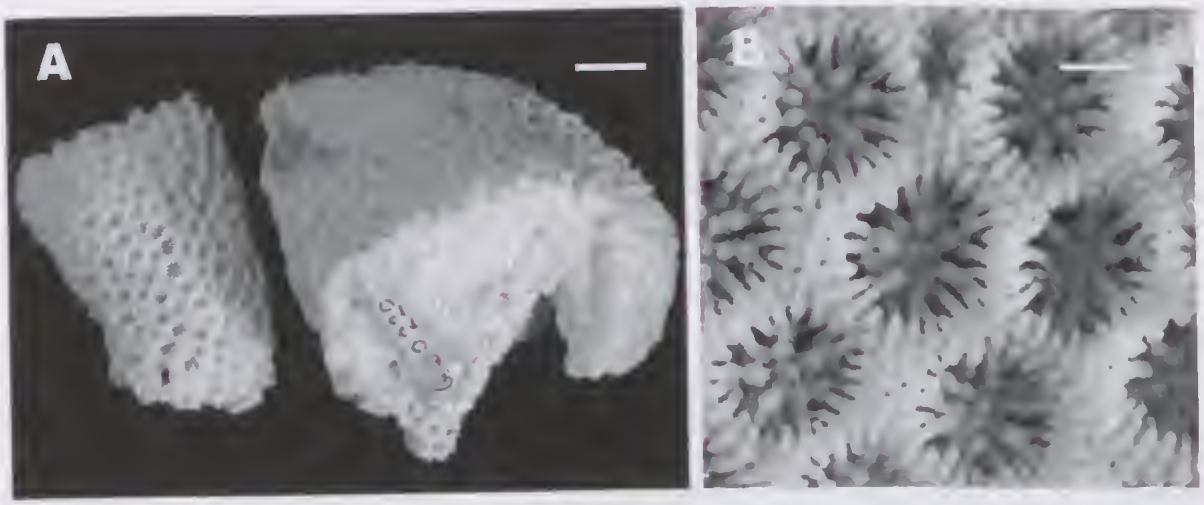

FIG. 29. *Goniopora tenuidens* from Goat Island (MTQ-G60220). A, portions of colony; B, close-up of colony. Scale bars: A = 10 mm; B = 1 mm.

IF, 2001; MTQ-G56610, Green I., CCW, IF, PRM, 2003; MTQ-G60192, Green I., CCW, PRM, 2007; MTQ-G57840, Wellington Point, PLH, 1991; MTQ-G57841, Moreton Bay, PLH, 1991. QM-G7013, Peel I., E. Lovell, 1972. *Fossil Moreton Bay*: University of Queensland specimen F17942 from Mud I. is mentioned in Wells (1955) [should now be in QM]. *Living outside Bay*: Flinders Reef, recorded Veron (1993).

Skeletal Characteristics. Corallum encrusting or sub-massive. Corallites round to polygonal and shallow, calices 1.3 to 2.9 mm diameter, 17–30 equal septa, with up to seven dentations on their upper surface; septa fused in groups of 2–6, with one member of the group reaching the columella.

Field Characteristics. Short, small polyps, not very obvious because columns very short; tentacles tapering. Colour usually pale brown or cream. A distinctive strong red colouration, sometimes seen elsewhere through its range, has not been noted in the bay.

Distribution. Central Indo-Pacific and Pacific Ocean to French Polynesia. East Australia: Great Barrier Reef south to Moreton Bay region.

Remarks. This species is distinctive for its extremely small corallites and polyps (almost similar in dimension to *Porites* corallites) and is easily distinguished from other *Goniopora* in the bay. Wells (1955) noted that a specimen of this species collected by Saville-Kent from Moreton Bay and recorded by Bernard (1903) as '*Goniopora* Great Barrier Reef 13' is this species. The date of that collection would be about 1889, and thus the species has longevity in the bay. Wells stated that it must be rare in the bay, but this is not so; it is just difficult to see because the flat colonies are pale in colour, and often hidden by silt.

Further Literature. Veron & Pichon (1982); Lovell (1989); Banks & Harriott (1995); Veron (2000).

Suborder FAVIINA Gregory, 1900

Diagnosis. Solitary and colonial corals; corallite walls epithecal, septothecal or parathecal. Septa formed by one or more fan systems of simple or compound trabeculae, ranging from isolated spines to imperforate laminae, margins more or less regularly dentate. Dissepiments well developed. Synapticulae very rare. *Mid Triassic to Recent.* (After Wells 1956).

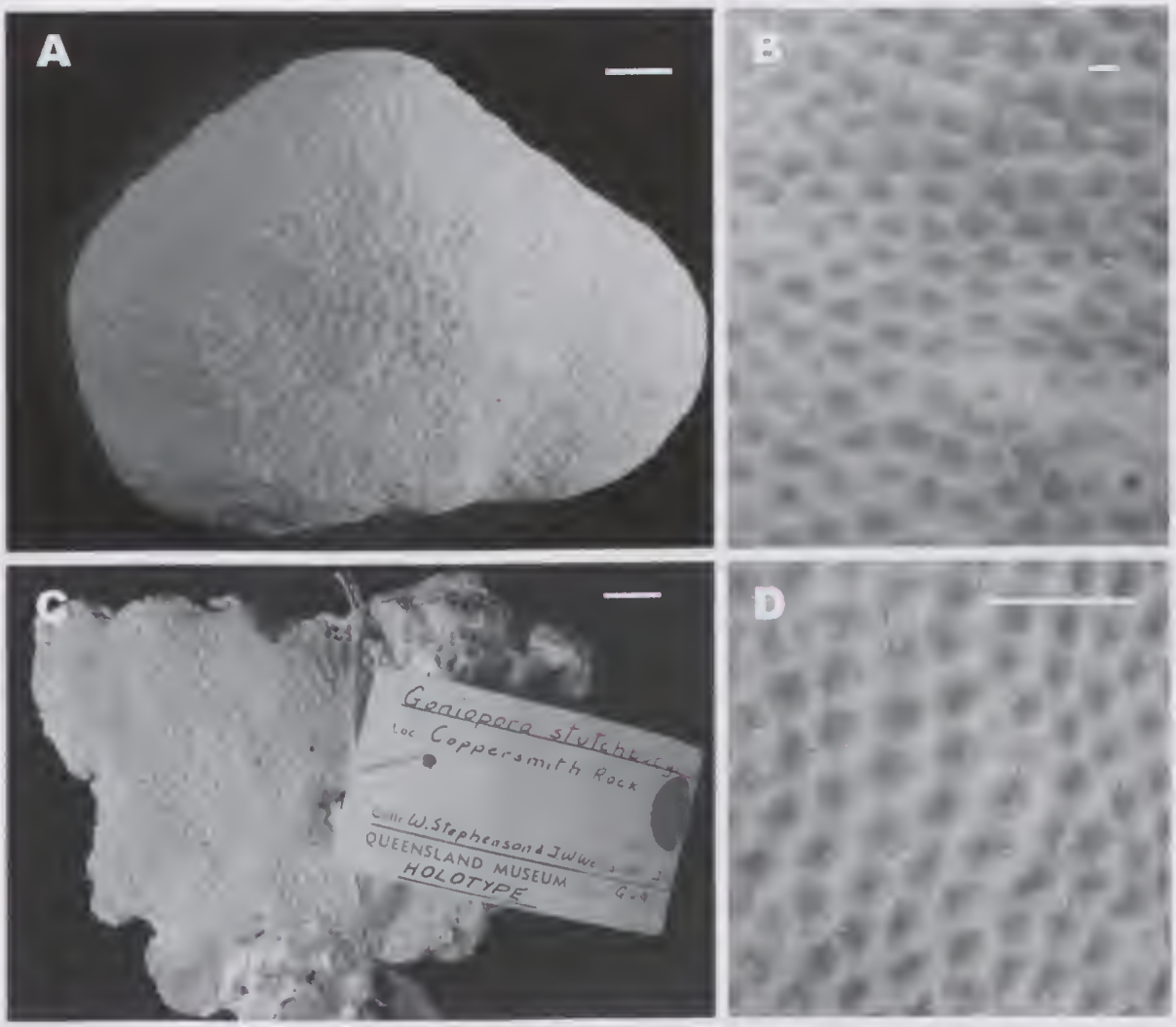

FIG. 30. *Goniopora stutchburyi*: A, B, from Green Island (MTQ-G56535); C, D, Holotype from Coppersmith Rock (QM-G2931). Scale bars: A, C = 10 mm; B = 1 mm; D = 5 mm.

FAVIIDAE Gregory, 1900

Diagnosis. Solitary and colonial, mostly hermatypic, colony formation by intratentacular budding (rarely extratentacular). Corallite walls septothecate or parathecate, rarely partially synapticulothecate. Septa formed by one fan system of simple trabeculae, commonly with small inner fan system. Columella usually present, trabecular or laminar. *Upper Jurassic to Recent.*

FAVIINAE Gregory, 1900

Diagnosis. Solitary and colonial faviids; hermatypic; colony formation by intra-tentacular budding.

Favia Oken, 1815

Type species. *Madrepora fragum* Esper, 1795.

Diagnosis. Colonies massive, corallites plocoid. Colonies formed by mono- to tristomodeal

budding, corallites permanently monocentric. Vesicular endo- and exothecal dissepiments. Columella trabecular and spongy. *Cretaceous to Recent.*

Favia favus (Forskål, 1775)
(Figs 5A, 31)

Madrepora favus Forskål, 1775: 132. [Type locality: Red Sea].
Madrepora cavernosa Forskål, 1775: 132.
Madrepora denticulata Ellis & Solander, 1786: 166, pl. 49, fig. 2.
Parastrea affinis Milne Edwards & Haime, 1850: 167.
Parastrea deformata Milne Edwards & Haime, 1850a: 168.
Parastrea savignyi Milne Edwards & Haime, 1850a: 173.
Parastrea jacquinoti Haime & Milne Edwards, 1857: 433.
Parastrea geoffroyi Haime & Milne Edwards, 1857: 433.
Parastrea aspera Haime & Milne Edwards, 1857: 438.
Favia ehrenbergi Klunzinger, 1879: 29, pl. 3.
Orbicella borradailei Gardiner, 1904: 775, pl. 63, fig. 33.

Material Examined. LECTOTYPE: Copenhagen Museum F28, Red Sea. *Living Moreton Bay*: MTQ-G57476–78, G57509, Peel I., CCW, IF, PRM, 2003; MTQ-G56548, G57858–59, Peel I., IF, 2001; MTQ-G56518–19, Peel Is, IF, 2002; MTQ-G57479–80, Green I., CCW, IF, PRM, 2003; MTQ-G58468–69, Peel I., CCW, IF, PRM, 2005; MTQ-G58475, G58477, Green I., CCW, IF, PRM, 2005; MTQ-G57480, Green I., CCW, IF, PRM, 2003; MTQ-G57861, Green I., CCW, IF, PRM, 2005; MTQ-G60178, G60180, Green I., H. Fukami, 2007; MTQ-G57835–36, Empire Point, PLH, 1991; MTQ-G57837, Wellington Point, PLH, 1991; MTQ-G601787, G60179, Goat I., H. Fukami, 2007; MTQ-G60175–76, Goat I., CCW, PRM, 2007; QM-G7009–10, Peel I., E. Lovell, 1972; QM-G6625, Green I., M. Dredge, 1971; MTQ-G61492, Polka Point, Dunwich, IF, 2002; MTQ-G5567, St. Helena I., M. Dredge, 1971. *Fossil Moreton Bay*: MTQ-G57481, G59638–40, Mud I., CCW, IF, PRM, 2003; MTQ-G57482, Empire Point, CCW, IF, PRM, 2003; MTQ-G57857, Mud I., IF, 2004; MTQ-G57856, Mud I., CCW, IF, PRM, 2005; MTQ-G57854–55, G61525, Empire Point, CCW, IF, PRM, 2005. *Living outside Bay*: Flinders Reef, recorded Veron (1993); Flinders Reef, sight record IF 2005.

Skeletal Characteristics. Corallum massive, rounded smooth-surfaced or irregular surfaced; corallites exhibit mono-, di- and tri-stomodial budding; non-dividing corallites round to oval (type with angular sides), close together but mostly not touching, exsert, cylindrical, 8–15 mm greatest diameter, depth 6–10 mm; septa 30–42, the first and second cycles reaching the columella, S1≈S2>S3>S4 (incomplete): septa exsert, with rounded tops with ragged irregular teeth with granulated sides and variable numbers of small to medium sized teeth. Paliform crown absent or paliform lobes visible on primary septa. Columella a small tangle of trabeculae or basal septal spines (large trabecular tangle in type). Costae with numerous minute teeth, costae meet but not continuous between corallites. (Costae of swollen type).

Field Characteristics. Well formed colonies up to and exceeding 500 mm diameter, distinguished by non-exsert, rounded corallites with evenly arranged and sized corallites. Colouration uniform, cream, yellow-brown, or pale brown.

Distribution. Widespread Indo-Pacific from East Africa, Red Sea and Arabian Gulf to French Polynesia. East Australia: Great Barrier Reef south to Solitary Islands, NSW.

Remarks. This is the commonest species of *Favia* now living in the bay and the commonest coral species overall. Earlier works often confused *Favia* species and may have used *Favia speciosa* for this species, e.g. some *F. speciosa* specimens from Lovell (1989) are re-interpreted as *F. favus* in this work. Many colonies collected appeared to be in an active state of growth, with numerous corallites in a state of division.

Johnson *et al.* 2008) recorded the pilumnid crab *Actumnus setifer* as being most commonly found in colonies of *Favia speciosa*, however as we here believe that *Favia favus* is the most common species in the bay and its identification has been confused with *F. speciosa*, it seems likely that it is actually *F. favus* that is the most common host for this crab. Alternatively, it may occur in a variety of *Favia* species.

Further Literature. Wijsman-Best (1974); Veron *et al.* (1977); Harriott *et al.* (1995); Veron (2000).

Favia maritima (Nemenzo, 1971)
(Figs 5D, 32)

Bikiniastrea maritima Nemenzo, 1971: 169, pl. 9, figs 1–2. [Type locality: Palawan, Phillipines].

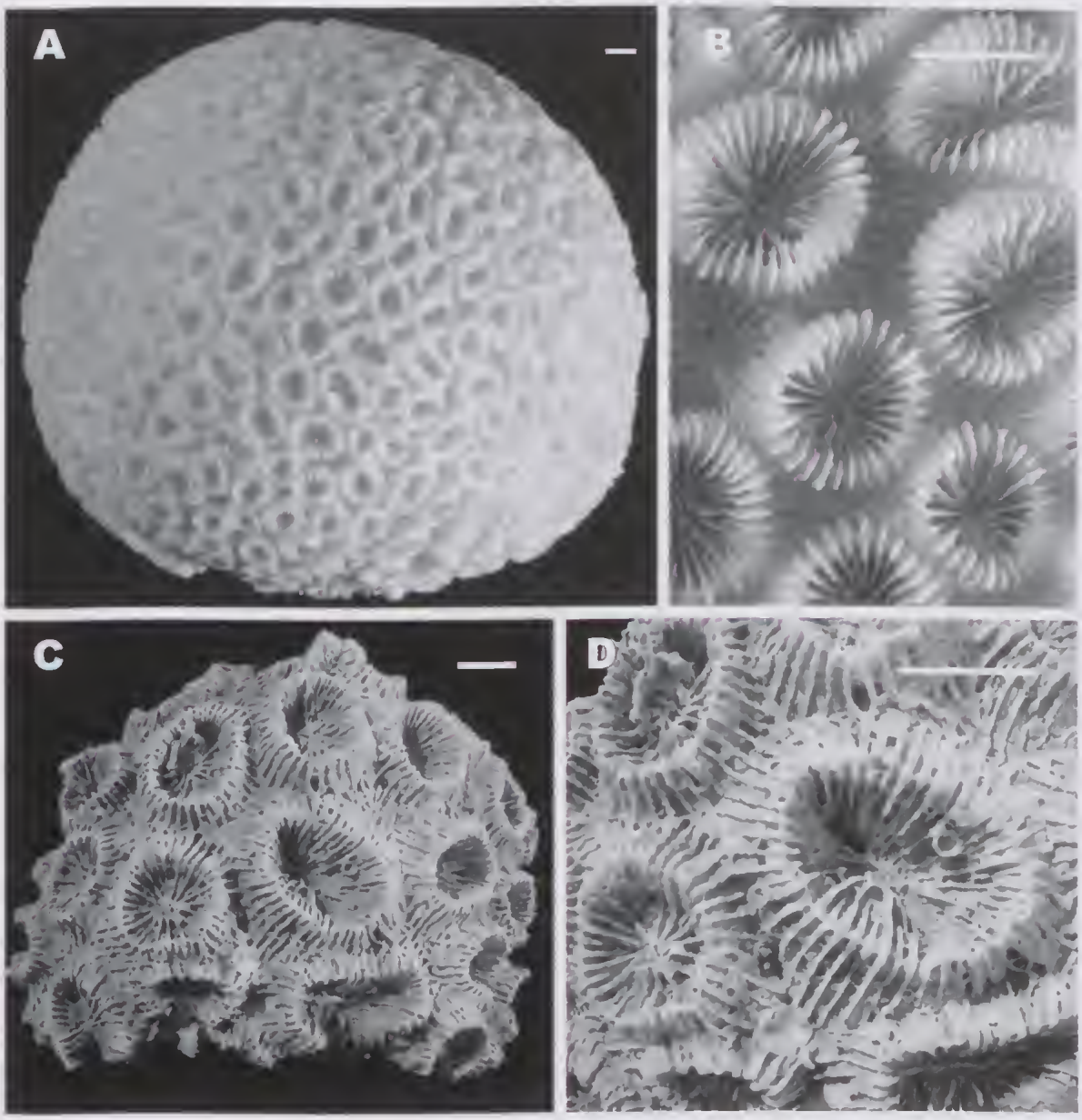

FIG. 31. *Favia favus*: A, B, from Peel Island (MTQ-G57859); C, D, fossil from Empire Point (MTQ-G57482). A, whole colony. C, portion of colony. B, D, close-up of part of colony. Scale bars: 10 mm.

Material Examined. *Living Moreton Bay*: MTQ-G56554, Peel I., IF, 2002; MTQ-G56560, Peel I., IF, 2001; MTQ-G56520, Peel I., IF, 2003; MTQ-G58466–67, Peel I., CCW, IF, PRM, 2005; MTQ-G60103–04, Peel I., H. Fukami, 2007; MTQ-G61494, Myora, H. Fukami, 2007; G57842–43, Green I., PLH, 1991; MTQ-G60105–06, Goat I., H. Fukami, 2007; MTQ-G57844, Moreton Bay, PLH, 1991; QM-G7005, G7007, Peel I., E. Lovell, 1972. *Fossil Moreton Bay*: MTQ-G56556, Mud I., CCW, IF, PRM, 2003; MTQ-G56557, G57485, G56563, Empire Point, CCW, IF, PRM, 2003. *Living outside Bay*: Flinders Reef, recorded Veron (1993).

Skeletal Characteristics. Corallum massive, domed or hemispherical. Corallites showing mono-, di- and tri-stomodeal budding; non-dividing corallites rounded or oval, walls flaring outwards to form a funnel shape, 1.5–17 mm exsert, greatest diameter 11–14 mm; depth 5–15 mm. Septa 28–49, the first and second cycles reaching the columella, S1≈S2>S3>S4; septa dentate with numerous, evenly arranged small teeth on top; within corallite, septal teeth irregular but mostly small; paliform crown irregularly present but some colonies without any paliform lobes. Columella a small tangle of trabeculae or basal septal spines. Costae with numerous fine teeth, some costae swollen, costae not continuous across coenosteum.

Field Characteristics. Colonies can reach beyond 500 mm in diameter; colours cream, dark brown, or brownish green with calicular ring paler.

Distribution. Indo-Pacific from East Africa to central Pacific. East Australia: Great Barrier Reef south to Moreton Bay region.

Remarks. Along with *Favia favus*, this species forms the largest-growing *Favia* colonies in Moreton Bay, and it is second only to *F. favus* in abundance. Previous records of *Favia speciosa* in Moreton Bay (e.g. Wells 1966; Lovell 1989) are likely to have included *F. maritima*. Small colonies of this species (up to about 100 mm diameter) may be difficult to distinguish from *Barabattoia* in the field.

Further Literature. Veron *et al.*(1977); Veron (2000).

Favia matthai Vaughan, 1918
(Figs 5G, 33)

Favia matthai Vaughan, 1918: 109, pl. 39, figs 2–2b. [Type locality: Western Indian Ocean].

Material Examined. *Living Moreton Bay*: MTQ-G55340, G57860, Peel I., CCW, IF, PRM, 2005; MTQ-G58474, G58476, Amity, CCW, IF, PRM, 2005; MTQ-G60157, Green I., H. Fukami, 2007; MTQ-G55341, Myora, CCW, IF, PRM, 2005. *Fossil Moreton Bay*: MTQ-G59636, Mud I., CCW, IF, PRM, 2003.

Skeletal Characteristics. Corallum massive, low dome-shaped to hemispherical. Corallites showing mono-, di- and tri-stomodeal budding; non-dividing corallites oval, irregular or elongate in shape, 9–14 mm greatest diameter; exsert, slightly funnel-shaped, 4–9 mm deep. Septa 27–40, S1≈S2>S3>S4 (incomplete); septa equally or irregularly exsert, with rounded to flattened tops with elaborate teeth; within corallite, septal teeth irregular, large and small, no paliform crown. Columella a light to dense tangle of basal septal spines. Costae with numerous small irregular teeth, some costae swollen; not continous across coenosteum.

Field Characteristics. Small to medium-sized massive colonies; corallite walls thickened and slightly irregular due to variety in septal thickness. Colour brown, pinkish brown or mottled.

Distribution. Widespread Indo-Pacific from East Africa and Red Sea to French Polynesia. East Australia: Great Barrier Reef south to Moreton Bay region.

Remarks. Although a paliform crown is characteristic of this species, there is no distinctive paliform crown in Moreton Bay specimens. This is consistent with a general trend for faviids in Moreton Bay waters.

Further Literature. Wijsman-Best (1972, 1974); Banks & Harriott (1995); Veron (2000).

Favia pallida (Dana, 1846)
(Figs 5F, 34)

Astraea pallida Dana, 1846: 224, pl. 10, figs 13–13e. [Type locality: Fiji].
Parastrea urvilleana Milne Edwards & Haime, 1850: 169.

Parastrea amplior Milne Edwards & Haime, 1850a: 172.
Parastrea doreyensis Milne Edwards & Haime 1850a: 168, pls 9, 22, 32.
Favia okeni Haime & Milne Edwards, 1857: 430.
Astrea ordinata Verrill, 1866: 34.
Favia tubulifera Klunzinger, 1879: 28, pl. 3, fig. 6, pl. 10, fig. 2.
Goniastrea serrata Ortmann, 1889: 526, pl. 15, fig. 10.
Favia laccadivica Gardiner, 1904: 769, pl. 62, fig. 24.

Material Examined. SYNTYPE: USNM-30, Fiji, US Exploring Expedition. *Living Moreton Bay*: MTQ-G57848–49, G57852, Peel I., PLH, 1991; MTQ-G56522, Peel I., IF, 2002; MTQ-G57847, Green I., PLH, 1991; MTQ-G57850–51, Wellington Point, PLH, 1991; MTQ-G61501, Goat I., H. Fukami, 2007; QM-GBRC 617, Peel I., C. Hedley, 1924; QM-G2805,

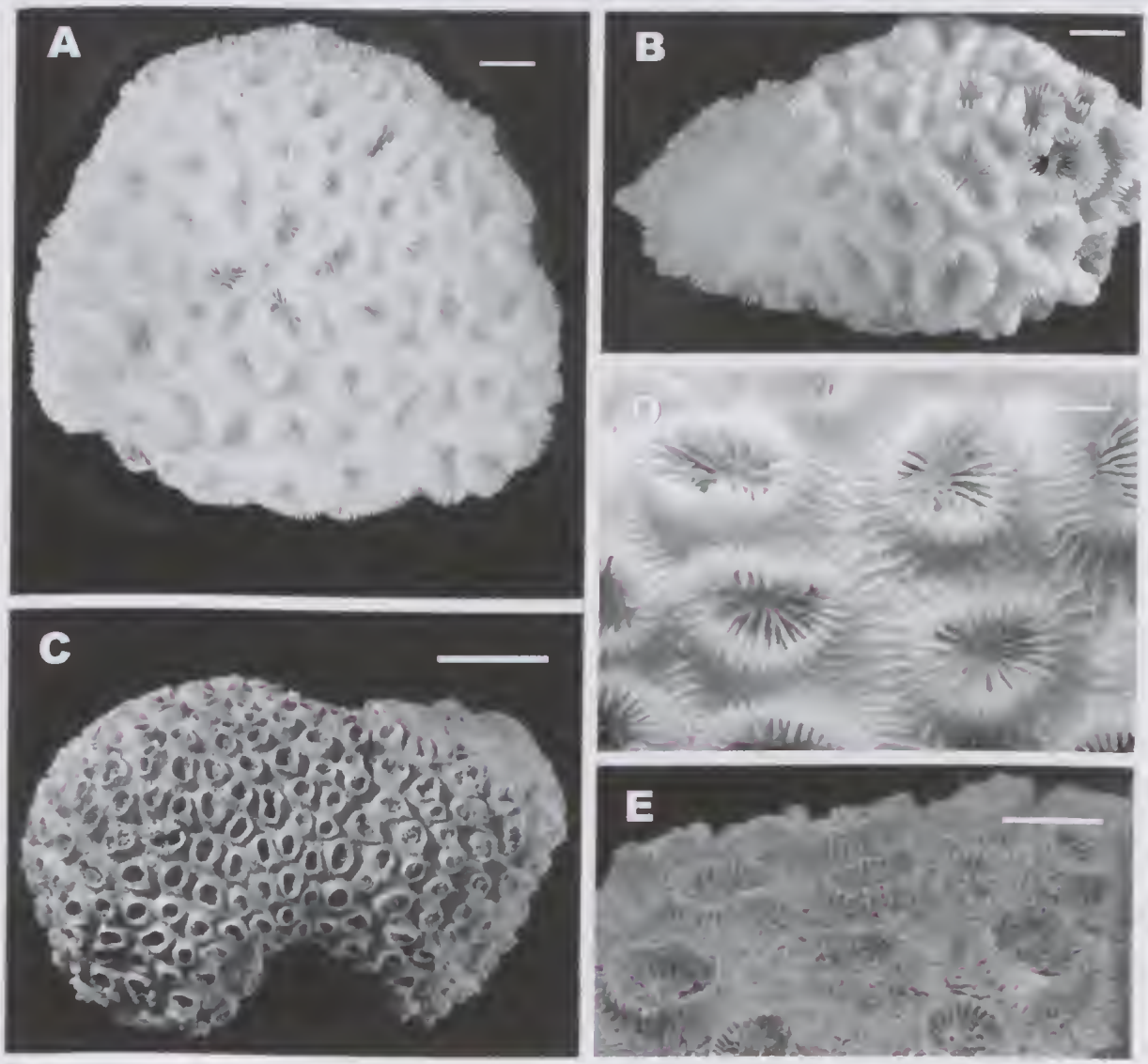

FIG. 32. *Favia maritima*: A, from Green Island (MTQ-G57842); B, D, from Peel Island (MTQ-G56520); C, E, fossil from Empire Point (MTQ-G56563). A, B, C, whole colony. D, E, close-up of part of colony. Scale bars: A, B, D, E = 10 mm; C = 50 mm.

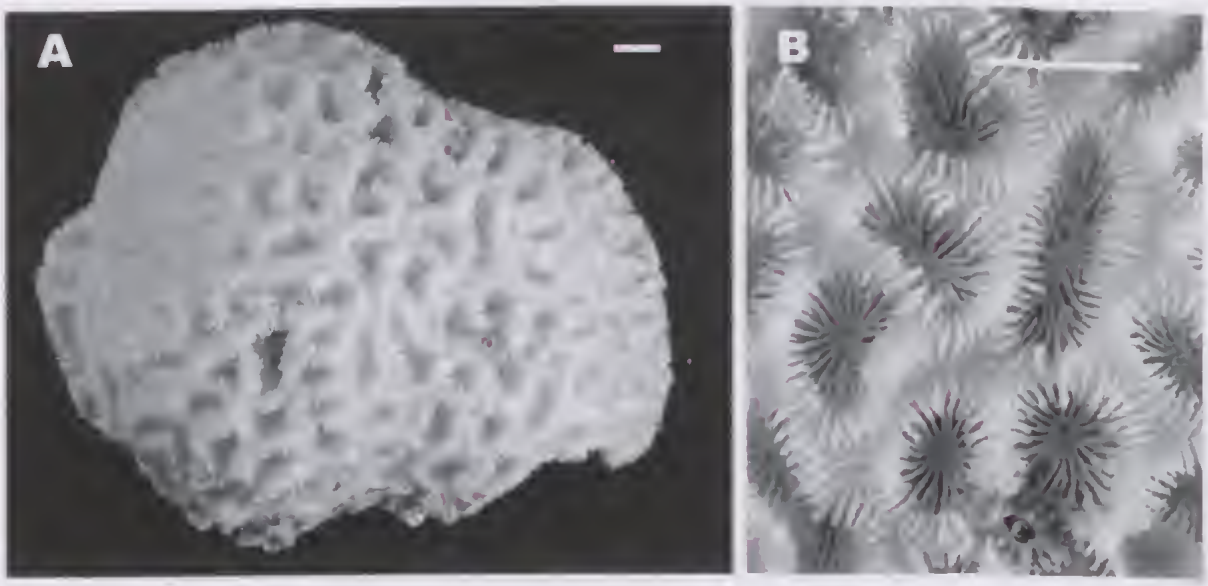

FIG. 33. *Favia matthai* from Amity (MTQ-G58476). A, whole colony. B, close-up of part of colony showing corallites. Scale bars: 10 mm.

Peel I., J.W.Wells, W. Stephenson, 1954; QM-G5725, St. Helena I., M. Dredge, 1971. *Fossil Moreton Bay*: MTQ-G57853, Empire Point, CCW, IF, PRM, 2005. *Living outside Bay*: QM-G7260, Flinders Reef, E. Lovell, 1973; Flinders Reef, visual record CCW, 2005.

Skeletal Characteristics. Corallum massive, hemispherical to dome-shaped; corallites exhibit mono-, di- and tri-stomodial budding; non-dividing corallites round to oval, 9.5–12.5 greatest diameter (syntype 7–11 mm), depth 2.5–7 mm; septa 26–42 (24–37 in type), first and most of the second second cycle reaching the columella, S1≈S2>S3>S4 (incomplete); septa exsert, with flat or slightly rounded tops with irregular fine teeth (swollen in type), within corallite teeth ragged, variable in size and number, mostly not present except towards base where a slight to marked paliform crown is formed; septal sides granulated. Columella a loose swirl to tight tangle of basal septal spines. Costae, where visible, with very small irregular teeth, mostly meeting across coenosteum but not continuous; strongly granulated on sides.

Field Characteristics. Hemispherical massive colonies up to 500 mm diameter, Colour pale brown or yellow-brown.

Distribution. Widespread Indo-Pacific from East Africa, Red Sea and Arabian Gulf to French Polynesia. East Australia: Great Barrier Reef south to Lord Howe Island, NSW.

Remarks. Although less common than some of the other *Favia* species in the bay, *F. pallida* appears to be well-established, with a possibly continuous history of occupancy in the bay. The specimens show some consistency with 'turbid water' forms of this species, as interpreted by Veron *et al.* (1977), in that corallites are deeper than in the syntype, columella and paliform crown are less developed. Specimen QM-G2805 is re-interpreted from *Favia speciosa* in Wells (1955).

Further Literature. Wijsman-Best (1972, 1974); Veron *et al.* (1977); Harriott *et al.* (1995); Veron (2000).

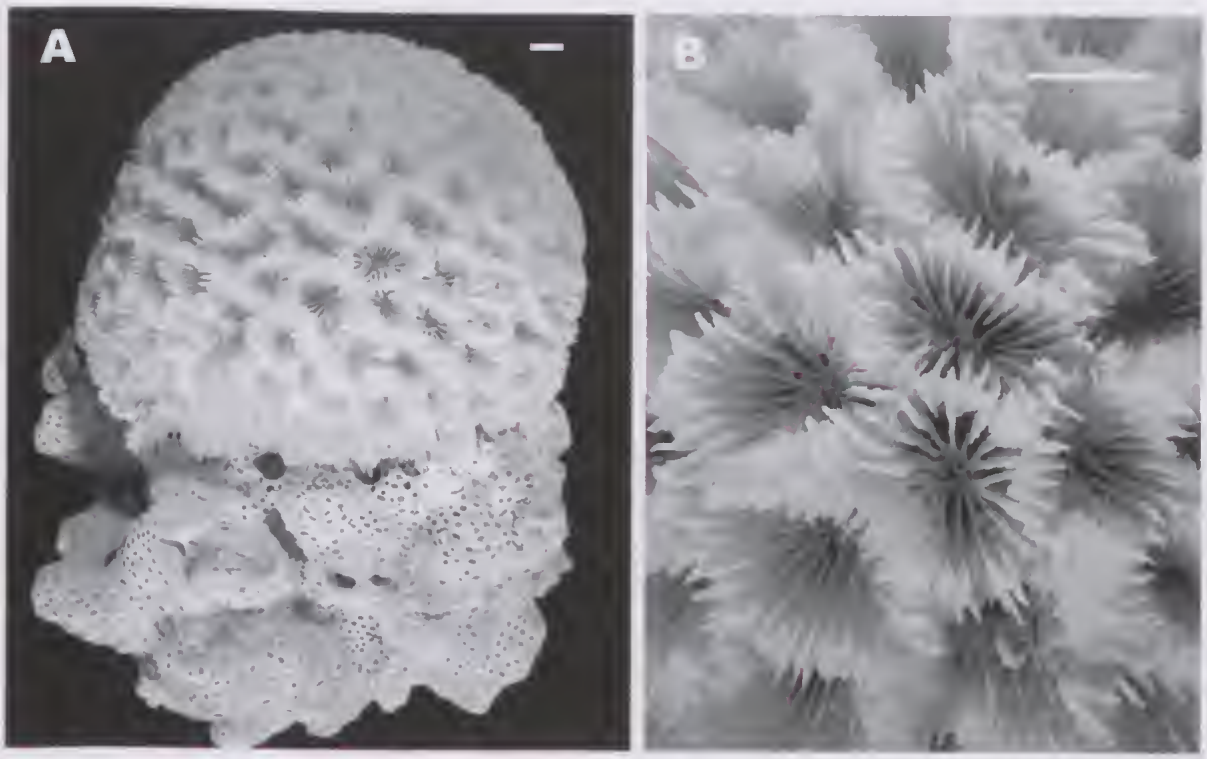

FIG. 34. *Favia pallida* from St Helena Island (QM-G5725). A, whole colony; B, close-up of part of colony showing corallites. Scale bars: 10 mm.

Favia speciosa (Dana, 1846)
(Figs 5E, 35)

Astrea (*Fissicella*) *speciosa* Dana, 1846: 220, pl. 43, figs 1–2. [Type locality: East Indies].

Material Examined. HOLOTYPE: USNM-37, East Indies, U.S. Exploring Expedition. *Living Moreton Bay*: MTQ-G56565, Peel I., CCW, IF, PRM, 2003; MTQ-G58885, Green I., CCW, IF, PRM, 2003; MTQ-G58957, Amity, CCW, IF, PRM, 2005; MTQ-G58958, Myora, CCW, IF, PRM, 2005; MTQ-G60183, Myora, H. Fukami, 2007; MTQ-G58954, Empire Point, IF, 2004; MTQ-G60184, Goat I., H. Fukami, 2007; QM-GBRC 618, GBRC 626, Peel I., C. Hedley, 1924; QM-G5887, Green I., M. Dredge, 1971; QM-G7011, Peel I., E. Lovell, 1972. *Fossil Moreton Bay*: MTQ-G58881, Mud I., IF, 2004; MTQ-G58882, Mud I., CCW, IF, PRM, 2003; MTQ-G58884, G59637, Empire Point, CCW, IF, PRM, 2003; QM-G2022, Goat I., Science Students Association, 1938; recorded as subfossil from Goat and Mud Is by Wells (1955). *Living outside Bay*: Flinders Reef recorded Veron (1993); sight record CCW, 2005. *Further south*: recorded to Cook I. (Harriott *et al.* 1999).

Skeletal Characteristics. Corallum massive, hemispherical to rounded and smooth-surfaced; corallites exhibit mono-, di- and tri-stomodial budding; non-dividing corallites round to oval, immersed to slightly exsert, 7.5–12.5 mm greatest diameter, depth 5–10.5 mm. Septa 31–49, first and second cycles reaching the columella, S1=S2>S3>S4 (incomplete); . Septa exsert, with tops subequal, rounded to flattened, with small ragged teeth; septal sides granulated, septa with few to numerous small to medium sized teeth. Paliform lobes only moderately developed, missing on most septa in some specimens. Columella small tangle of trabeculae or basal teeth. Costae with granulations on sides and numerous fine teeth; meet, but not continuous, between corallites.

Field Characteristics. Hemispherical colonies with small corallites with a neat appearance due to regularly arranged and shaped septa. Colour cream, grey-green or pale brown.

Distribution. Widespread Indo-Pacific from East Africa, Red Sea and Arabian Gulf to French Polynesia. East Australia: Great Barrier Reef south to Lord Howe Island, NSW.

Remarks. Some confusion has existed in the interpretation of *Favia speciosa* and *Favia favus* in Moreton Bay over the years, however *F. speciosa* is not currently as abundant as *F. favus*. See other remarks under *F. favus* above.

Further Literature. Wijsman-Best (1972); Banks & Harriott (1995); Harriott *et al.* (1995); Veron (2000).

Favia rotumana (Gardiner, 1899) (Figs 5C, 36)

Astrea rotumana Gardiner, 1899: 750, pl. 57, fig. 3. [Type locality: Rotuma, Pacific Ocean].

Material Examined. *Living Moreton Bay*: MTQ-G56521, Peel I., IF, 2002; MTQ-G56551, Peel I., CCW, IF, PRM, 2003; MTQ-G58470, Myora, IF, 2005; MTQ-G58471, Myora, CCW, IF, PRM, 2005; MTQ-G61495–97, Myora, H. Fukami, 2007; MTQ-G61498, Green I., H. Fukami, 2007; MTQ-G57864, Polka Point, Dunwich, IF, 2002; MTQ-G57865, Polka Point, Dunwich, IF, 2004; MTQ-G61500, Goat I., H. Fukami, 2007; MTQ-G61507–09, Goat I., CCW, PRM, 2007; MTQ-G59219, Moreton Bay, PLH, ~1991; QM-G5566, St. Helena I., M. Dredge, 1971. *Fossil Moreton Bay*: MTQ-G57862–63, G61546, Mud I., CCW, IF, PRM, 2005. *Living outside Bay*: MTQ-G61499, Flat Rock, H. Fukami, 2007; Flinders Reef, sight record IF, 2005.

Skeletal Characteristics. Corallum massive, domed, with a rounded to slightly irregular surface, corallites showing mono-, di- and tristomodeal budding; non-dividing corallites round to oval 10–21 mm greatest diameter; exsert, irregular cylindrical, depth 6–13 mm. Septa 29–48, first and second cycles reaching the columella, S1≈S2>>S3>S4; Septa exsert, of irregular height, tops flat to slightly rounded and swollen, with numerous irregular teeth; within corallite, septal teeth ragged, variable in number and irregularly distributed; sides granulated, slight to strong paliform crown present. Columella a small, light to dense tangle of basal septal spines. Costae with numerous small irregular teeth, costae not continous across coenosteum but sometimes meeting.

Field Characteristics. Rounded colonies to 500 mm or sometimes larger, with corallites large, deep and slightly funnel-shaped. Both walls and tops of corallites have an extremely irregular surface and this species is distinctive amongst *Favia* for this character. Colour brown or green-brown, sometimes with brown walls and green centres.

Distribution. Widespread Indo-Pacific from East Africa, Red Sea and Arabian Gulf to Pitcairn Islands. East Australia: Great Barrier Reef south to Moreton Bay region.

Remarks. The large corallites and extremely irregular corallite structure of this species are distinctive. This species appears to have previously gone unnoticed in Moreton Bay (as for some of other species of *Favia*), however the specimen collected in 1971, together with the fossil records, suggest it has been in the bay for a long time.

Further Literature. Wijsman-Best (1974); Veron *et al.* (1977); Veron (2000).

Favia veroni Moll & Borel-Best, 1984 (Figs 5B, 37)

Favia veroni Moll & Borel-Best 1984: 48, figs 1–3. [Type locality: Kudingareng Keke, Spermonde Arch., Indonesia].

Material Examined. *Living Moreton Bay*: MTQ-G56569, Green I., CCW, IF, PRM, 2003; MTQ-G60159, Goat I., CCW, PRM, 2007. *Fossil Moreton Bay*: MTQ-G56570, Empire Point, CCW, IF, PRM, 2003. *Living outside Bay*: Flinders Reef, visual record CCW, 2005.

Skeletal Characteristics. Corallum massive, hemispherical with flat top. Corallites showing mono- and di- stomodeal budding; non-dividing corallites triangular to oval; exsert 6–11 mm, walls sloping outwards, 17–20 mm greatest diameter, depth 7–11 mm. Septa 40–58, first and most of second cycle reaching the columella, S1≈S2>S3>S4; septa exsert, slightly swollen, the tops rounded, with small teeth; within corallite,

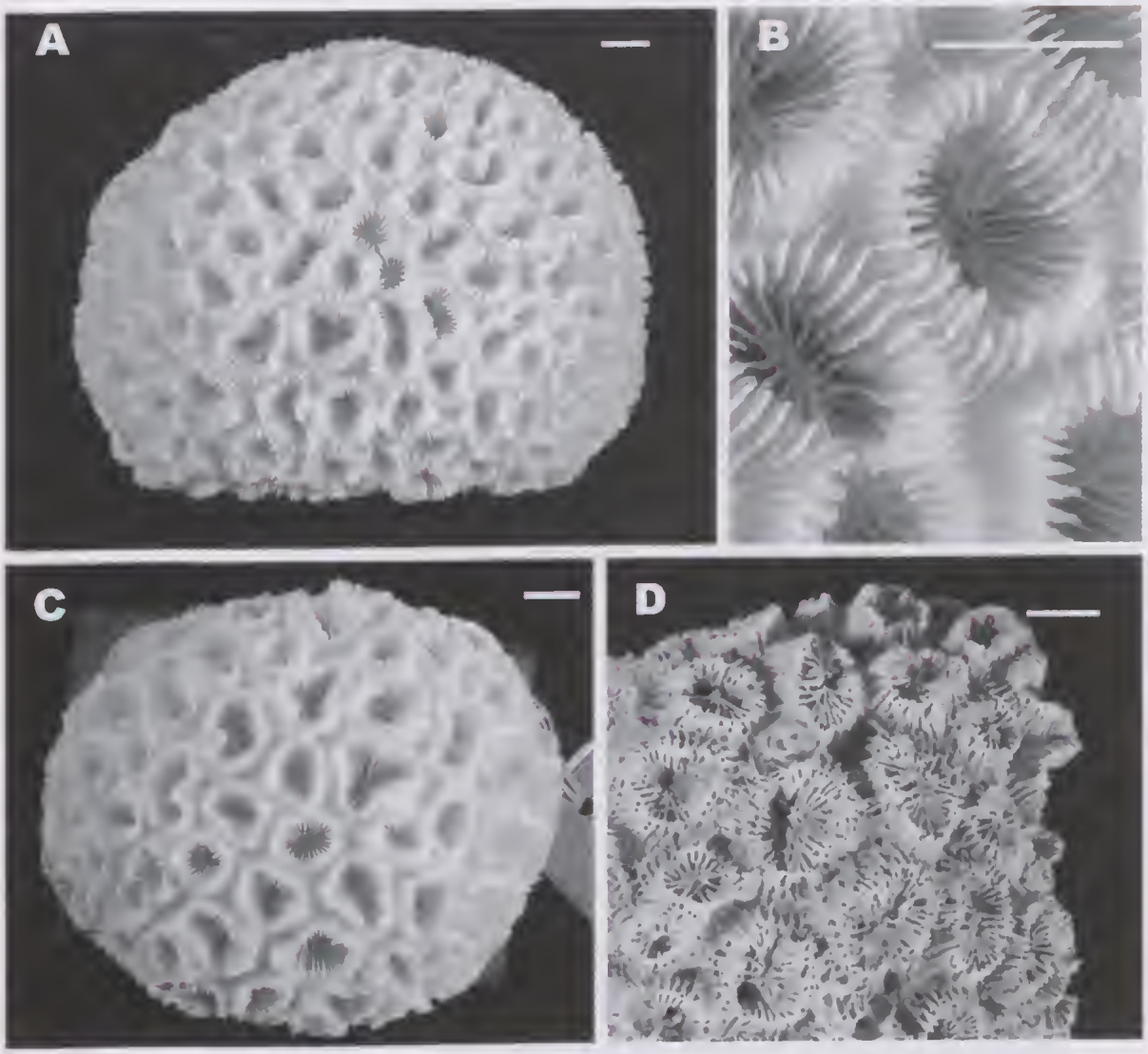

FIG. 35. *Favia speciosa*: A, B, from Peel Island (QM-GBR618); C, Holotype (USNM-37, East Indies). D, fossil from Empire Point (MTQ-G59637). Scale bars: 10 mm.

septa with both lobes and teeth; no paliform crown. Columella a small to medium sized trabecular tangle. Costae with numerous small irregular teeth; costae not continous across coenosteum. Coenosteum blistered.

Field Characteristics. Massive, hemispherical colonies, distinguished by very large corallites. No colonies over about 300 mm were seen in the bay. Colouration seen was light brown with pink and blue tonings.

Distribution. Patchy Indo-Pacific, mainly restricted to central Indo-Pacific and western Pacific (map in Veron 2000). East Australia: Great Barrier Reef south to Moreton Bay region.

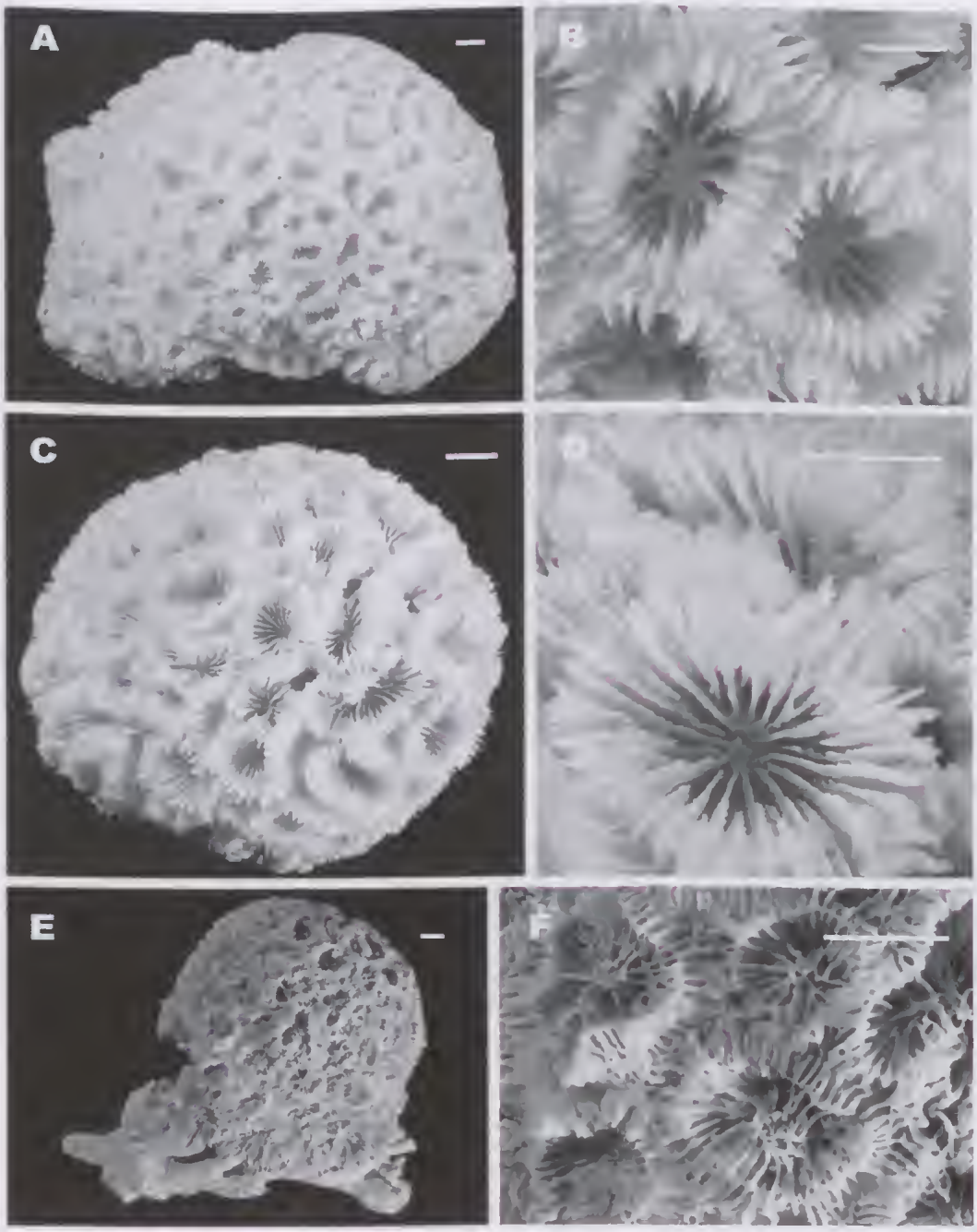

FIG. 36. *Favia rotumana*: A, B, from Peel Island (MTQ-G56521); C, D, from St. Helena Island (QM-G5566); E, F, fossil from Mud Island (MTQ-G57863). A, C, E, whole colony; B, D, F, close-up of part of colony showing corallites. Scale bars: A, C, E, F = 10 mm; B, D = 5 mm.

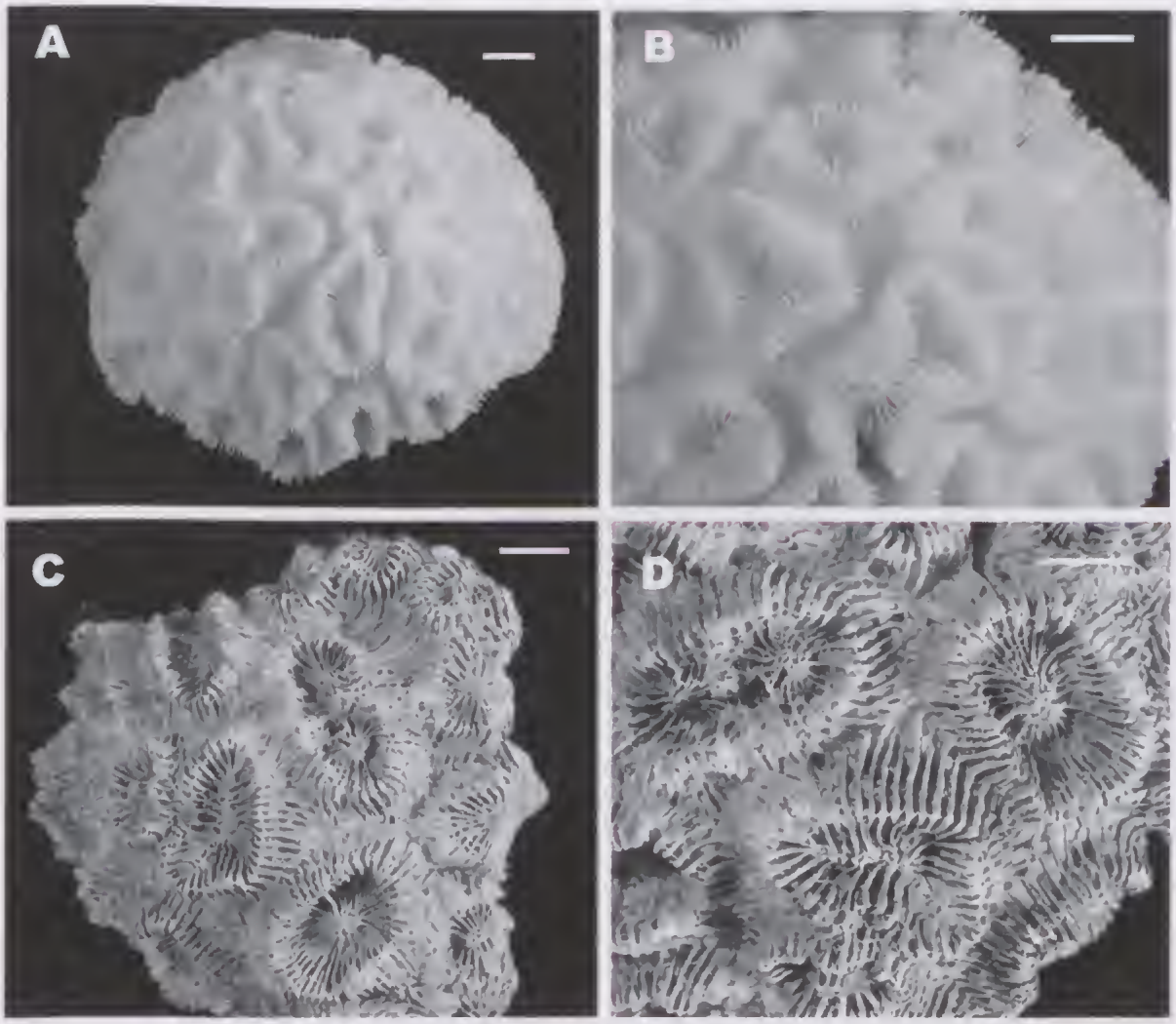

FIG. 37. *Favia veroni*: A, B, from Green Island (MTQ-G56569); C, D, fossil from Empire Point (MTQ-G56570). A, C, whole colony; B, D, close-up of part of colony. Scale bars: 10 mm.

Remarks. This is not a common species in the bay but it was quite frequently collected, possibly because of the distinctive appearance amongst the larger and duller colonies of other *Favia*. The colony in Fig. 5B has almost every polyp dividing.

Further Literature. Veron (2000).

Barabattoia Yabe & Sugiyama, 1941

Type species. *Barabattoia mirabilis* Yabe & Sugiyama, 1941.

Diagnosis. Subplocoid, with monocentric tubular corallites free at summits; colony formation by intra- and extra-tentacular budding. Septa and costae coverd by minute granules. *Recent*.

Barabattoia amicorum (Milne Edwards & Haime, 1848) (Figs 6H, 38)

Parastrea amicorum Milne Edwards & Haime, 1848e: 320, pl. 9, fig. 9; 1849b: 171 (description). [Type locality: Tonga].
Barabattoia mirabilis Yabe & Sugiyama, 1941: 72, pl. 61, figs 1–1e.
Barabattoia goroensis Yabe & Sugiyama, 1941: 73, pl. 61, figs 2–2a.
Barabattoia modesta Nemenzo, 1971: 175, pl. 10, fig. 1.
[synonymy from Veron, Pichon & Wijsman-Best, 1977: 32; modified Veron & Pichon 1982: 136].

Material Examined. *Living Moreton Bay*: MTQ-G56558, G56561, Peel I. IF, 2001; MTQ-G57798, Peel I., PLH, 1994; MTQ-G57804–05, Peel I., PLH, 1991; MTQ-G58890, Peel I., PLH, 1991? ; MTQ-G58464–65, G58472–73, Peel I., CCW, IF, PRM, 2005; MTQ-G60101, Green I., H. Fukami, 2007; MTQ-G58478, Empire Point, CCW, IF, PRM, 2005; MTQ-G60102, Goat I., CCW, PRM, 2007; QM-G2806–07, Peel I., J.W.Wells, W. Stephenson, 1954; QM-GL3813, GL3840, Peel I., C. Hedley, 1924; QM-G6966, Peel I., E. Lovell, 1971; QM-G6969, G7003, Peel I., E. Lovell, 1972.

Skeletal Characteristics. Corallum sub-massive, plocoid and exsert, with some exsert tubular corallites; budding intratentacular, mono- to tristomodeal; occasionally extratentacular. Non-budding corallites up to 11 mm diameter. Septa first and second cycles reaching the columella, S1≈S2≈S3>S4; primary and secondary septa swollen at top. Columella small and trabecular. Costae equal, beaded and with fine teeth.

Field Characteristics. Colonies small, mostly under 200 mm diameter; colour pale brown or greenish brown.

Distribution. Central Indo-Pacific and Pacific Ocean to French Polynesia. East Australia: Great Barrier Reef south to Moreton Bay region.

Remarks. This species is difficult to distinguish from small colonies of *Favia maritima* in the field.

Further Literature. Wijsman-Best (1974) (as *Favia amicorum*); Veron *et al.* (1977); Veron (1986); Veron (2000).

Favites Link, 1807

Type species. *Favites astrinus* Vaughan, 1901.

Diagnosis. Colonies cerioid and usually massive, formed by mono- to tristomodeal intratentacular budding, permanent corallite state monocentric. Vesicular endo- and exothecal dissepiments. Columella trabecular and spongy. *Eocene to Recent.*

Favites abdita (Ellis & Solander, 1786) (Fig. 39)

Madrepora abdita Ellis & Solander, 1786: 162, pl. 50, fig. 2. [Type locality: unknown].
Favastrea magnifica de Blainville, 1830: 340.
Astrea fusco-viridis Quoy & Gaimard, 1833: 215, pl.17 figs 8–9.
Astrea hemprichii Ehrenberg, 1834: 320.
Astrea robusta Dana, 1846: 248, pl. 13, figs 10–10d.
Prionastrea obtusata Milne Edwards & Haime, 1850: 130.
Prionastrea quoyi Milne Edwards & Haime, 1850: 130.
Prionastrea profundicella Milne Edwards & Haime, 1850: 131.
Prionastrea crassior Milne Edwards & Haime, 1850: 131.
Prionastrea seychellensis Milne Edwards & Haime, 1850: 132.
Prionastrea sulfurea Milne Edwards & Haime, 1850: 130.
Prionastrea gibbosa Klunzinger, 1879: 3, 40, pl. 4, fig. 10.

Material Examined. SYNTYPE (*Astraea robusta* Dana, 1846): USNM-63, Fiji. *Living Moreton Bay*: MTQ-G60160, Goat I., CCW, PRM, 2007. *Fossil Moreton Bay*: QM-G2020, Bird-Goat I., Science Students' Association, 1938; MTQ-G61535–36, Empire Point, CCW, IF, PRM, 2005; MTQ-G60194, Mud I., PRM, 2007; UQ Collection temporary no. 012, 014, Moreton Bay; recorded as sub-fossil from Goat and Mud Islands by Wells (1955). *Living outside Bay*: Flinders Reef, recorded Veron (1993); Flinders Reef, visual record IF, 2005. *Further south*: recorded to Julian Rocks, NSW (Harriott *et al.* 1999).

Skeletal Characteristics. Corallum massive, rounded or irregular (hillocky). Corallites with angular outline and thin sharp-edged walls; budding intratentacular, mostly monostomodeal. Non-budding corallites 10–14 mm diameter. Septa first and second cycles reaching the columella, S1=S2>S3>S4; septa have a small number of large teeth increasing in size towards the columella. Septa not always continuous across wall; barely exsert on top, except for teeth; no paliform crown. Columella a broad, dense tangle of trabeculae.

Field Characteristics. Irregular massive colonies to over 500 mm in diameter. Angular edges to

corallites obvious. Colour dark brown, sometimes with green oral discs.

Distribution. Widespread Indo-Pacific from East Africa, Red Sea and Arabian Gulf to French Polynesia. East Australia: Great Barrier Reef south to Lord Howe Island, NSW.

Remarks. Neither this species nor *Favites halicora* seem to be as prevalent in the bay as they were in Lovell's (1989) surveys.

Further Literature. Lovell (1989); Banks & Harriott (1995); Harriott *et al.* (1994, 1995).

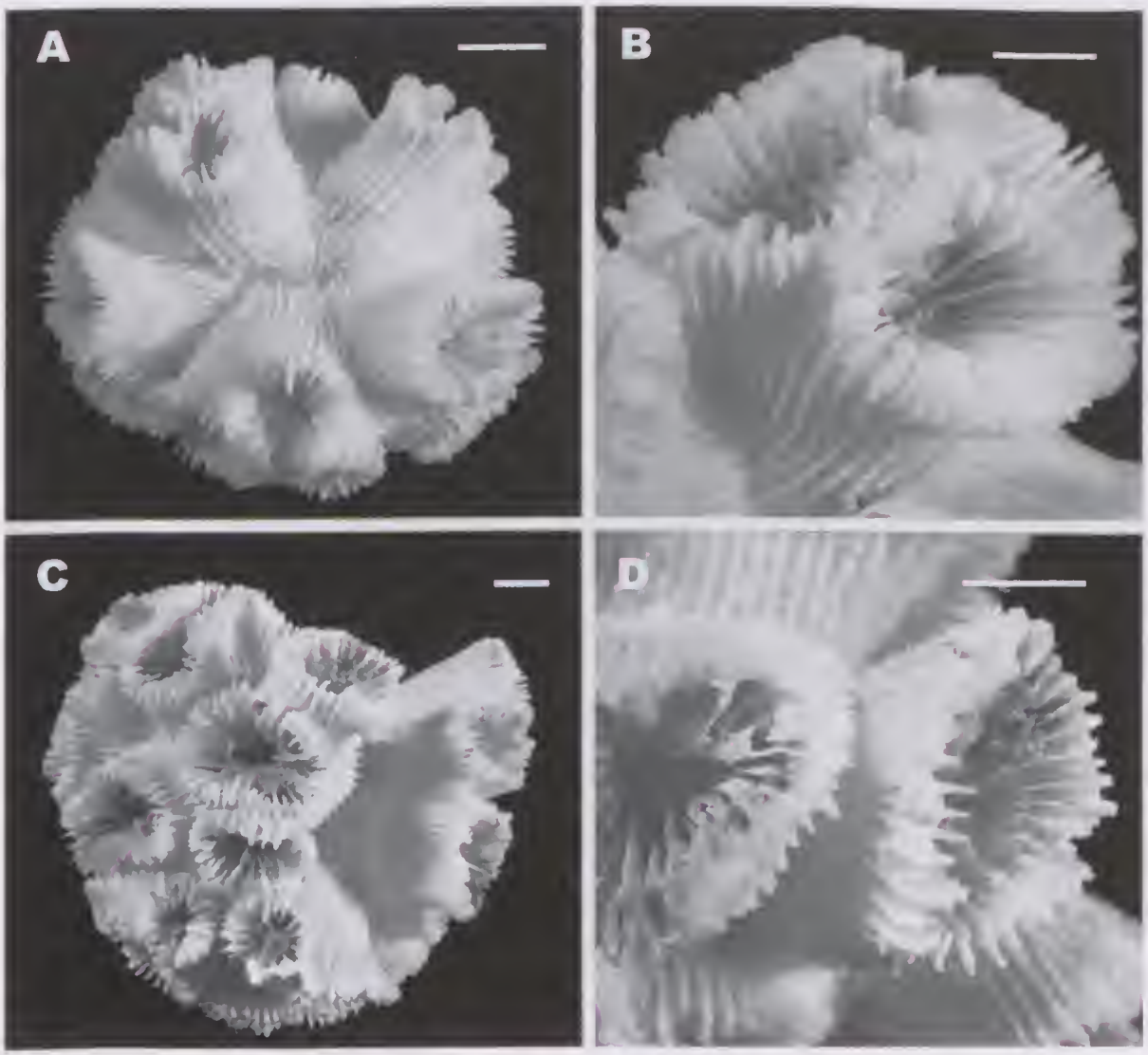

FIG. 38. *Barabattoia amicorum*: A, B, from Peel Island (QM-G7003); C, D, from Peel Island (QM-GL3813). A, C, whole colony; B, D, close-up of part of colony. Scale bars: 10 mm.

Favites flexuosa (Dana, 1846)
(Fig. 40)

Astrea flexuosa Dana, 1846: 227, pl. 11, figs 6–6e. [Type locality: Fiji].
Astrea virens Dana, 1846: 228, pl. 11, figs 8, 8a–d.
Prionastraea vasta Klunzinger, 1879: 38, pls 4, 10.
Favites ellisiana Verrill, 1901: 92.

Material Examined. SYNTYPE (*Astrea flexuosa* Dana, 1846): USNM 27, Fiji, US Exploring Expedition. *Living Moreton Bay*: MTQ-G56562, Peel I., IF, 2001; MTQ-G56524, G56532, G56534, Peel I., IF, 2002; MTQ-G59432, Peel I., PLH, 1991; MTQ-G59213, Empire Point, PLH, 1991; MTQ-G59212, Wellington Point, PLH, 1991; MTQ-G60169, Goat I., CCW, PRM, 2007. *Fossil Moreton Bay*: MTQ-G57470, G59210, Empire Point, CCW, IF, PRM, 2003. *Living outside Bay*: MTQ-G59211, Flat Rock, CCW, IF, PRM, 2005. *Further south*: recorded to Julian Rocks, NSW (Harriott *et al.* 1999).

Skeletal Characteristics. Corallum low massive or thick encrusting, with a smooth to slightly irregular surface. Corallites exhibit monostomodeal budding, mostly around periphery (syntype of *A. robusta* also with di- and tri-stomodial budding); non-dividing corallites with angular sides and sometimes elongate, 10–25 mm greatest diameter, depth 3.5–12 mm. Septa 32–53, first and some of second cycles reaching the columella, S1=S2>S3>S4; some septa join in a deltaic pattern. Septa very slightly exsert, with large teeth at the tops and 7–8 large teeth inside the corallite, increasing in size towards the columella; no paliform lobes, septal sides granulated. Columella a small tangle of granulated and twisted septal teeth.

Field Characteristics. Semi-encrusting to low massive colonies with large and somewhat superficial corallites with obvious teeth. Colour cream, pale brown, grey, grey-brown or apple green, oral discs sometimes green.

Distribution. Widespread Indo-Pacific from East Africa and Red Sea to French Polynesia. East Australia: Great Barrier Reef south to Lord Howe Island, NSW.

Remarks. This widespread species is apparently well-established in Moreton Bay. Its absence from earlier collections could possibly be due to its mostly sub-tidal habitus.

Further Literature. Wijsman-Best (1972); Veron *et al.* (1977); Harriott *et al.* (1994, 1995); Veron (2000).

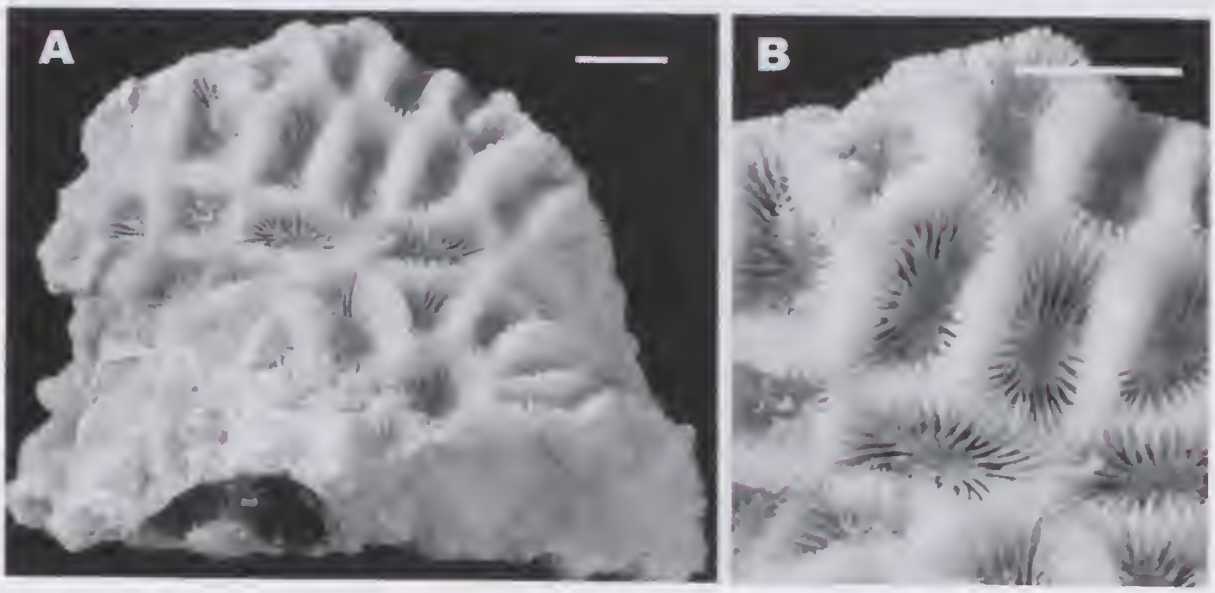

FIG. 39. *Favites abdita* from Goat Island (MTQ-G60160). A, whole colony; B, close-up of part of colony. Scale bars: 10 mm.

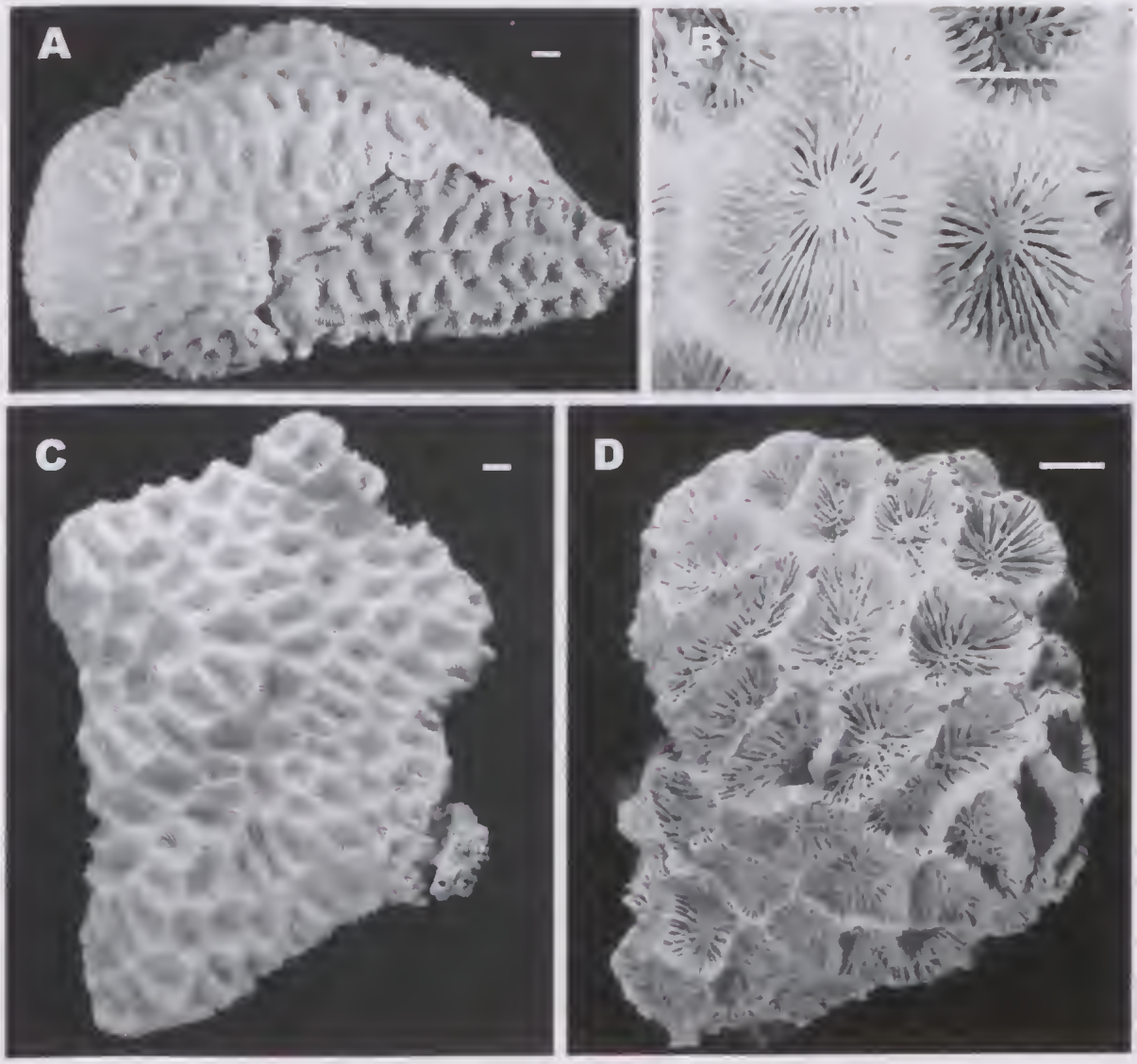

FIG. 40. *Favites flexuosa*: A, B, from Peel Island (MTQ-G56532); C, from Peel Island (MTQ-G56562); D, fossil from Empire Point (MTQ-G59210). A, C, D, whole colony; B, close-up of part of colony. Scale bars: 10 mm.

Favites halicora (Ehrenberg, 1834) (Figs 5H, 41)

Astrea halicora, Ehrenberg, 1834: 321. [Type locality: Red Sea].

Material Examined. *Living Moreton Bay*: MTQ-G56525, Peel I., IF, 2002. *Fossil Moreton Bay*: MTQ-G60194, Mud I., PRM, 2007; QM-G2020, Goat I., Science Students Association, 1938: '013' Moreton Bay University of Queensland Collection; recorded as subfossil from Goat and Mud Is by Wells (1955). *Living outside Bay*: QM-G7312, G7314, Flinders Reef, E. Lovell, 1972; QM-G7313, Flinders Reef, E. Lovell, 1973. *Further south*: recorded to Solitary Is. (Harriott *et al.* 1994).

Skeletal Characteristics. Corallum massive to sturdy encrusting, with an irregular surface. Corallites exhibit a small amount of monostomodeal budding, mostly around periphery. Corallites with angular sides or elongate; greater diameter 12–17 mm; calice depth 5.5–9 mm. Septa 28–48, first and most of the second cycle reaching the columella, S1=S2>S3>S4;. Septa irregular, exsert, with large teeth at the tops and numerous irregular teeth inside the corallite, increasing in size towards the columella and with granulated sides; little or no paliform development. Columella a dense oval tangle of granulated and flattened trabeculae.

Field Characteristics. Irregular massive colonies to over 500 mm in diameter. Corallite walls thick. Colour yellowish or greenish brown.

Distribution. Indo-Pacific from S. East Africa and Red Sea to Fiji. East Australia: Great Barrier Reef south to Solitary Islands, northern NSW.

Remarks. This species is distinguished from *Favites abdita* by its thick corallite walls, versus the sharp walls of *F. abdita*.

Further Literature. Veron *et al.* (1977); Lovell (1989); Harriott *et al.* (1994); Banks & Harriott (1995); Veron (2000).

Favites chinensis (Verrill, 1866) (Fig. 42)

Prionastrea chinensis Verrill, 1866: 35. [Type locality: Hong Kong].

Prionastrea auticollis Ortmann, 1889: 528, pl. 16, fig. 11.

Favites yamanarii Yabe, Sugiyama & Eguchi 1936: 33, pl. 19, fig. 10.

Material Examined. *Living Moreton Bay*: MTQ-G57484, G59223, Wellington Point, IF, 2003. *Living outside Bay*: MTQ-G60186–88, Flat Rock, H. Fukami, 2007; MTQ-G60185, Shag Rock, H. Fukami, 2007; QM-G7271, Flinders Reef, E. Lovell, 1973. *Further south*: recorded to Cook I. (Harriott *et al.* 1999).

Skeletal Characteristics. Corallum submassive, smooth, with a flat top. Corallites undergoing monostomodeal budding, oval, immersed and 9.5–14 mm greatest diameter; depth 4–7.5 mm. Septa 27–35, first and second cycles reaching the columella, S1=S2>S3>S4;. Septa regularly and widely spaced; exsert, tops lobed, the lobes swollen in one specimen; inside corallite, septa with lobes and large teeth and granulated sides; paliform lobes absent or just slightly developed. Columella a small dense tangle of twisted basal septal spines, deep within the corallite.

Field Characteristics. Flat-topped massive colonies up to 400 mm diameter. Colour pale brown.

Distribution. Widespread Indo-Pacific from East Africa, Red Sea and Arabian Gulf to central Pacific. East Australia: Great Barrier Reef south to Cook Island, northern NSW.

Remarks. This species has been previously recorded from Moreton Bay by Wijsman-Best (1972) based on a specimen in the Natural History Museum, London (BMNH-1892.12.1.399), that was probably originally collected by Saville-Kent.

Further Literature. Wijsman-Best (1972); Veron *et al.* (1977); Harriott *et al.* (1999); Veron (2000).

Goniastrea Milne Edwards & Haime, 1848

Type species. *Goniastrea retiformis* Lamarck, 1816.

Diagnosis. Cerioid, sub-meandroid or meandroid; colony formation by mono- to polystomodeal budding; septa usually with paliform lobes and small, regular dentations; columella feeble. *Eocene to Recent.*

Goniastrea aspera Verrill, 1866 (Figs 6B, D, 43)

Goniastrea aspera Verrill, 1866: 32. [Type locality: Ryuku Islands, Japan].

Favites spectabilis Verrill, 1872: 92.

Goniastrea incrustans Duncan, 1889.

Goniastrea mantonae Crossland, 1952:136, pl. 7, figs 1–2.

Goniastrea equisepta Nemenzo, 1959: 101–102, pl. 10 fig. 1.

Material Examined. *Living Moreton Bay*: MTQ-G59222, Peel I., PLH, 1991?; MTQ-G59372–74, Peel I., PLH, 1991; MTQ-G57866, Peel I., PLH, 1994; MTQ-G56527, Peel I., IF, 2001; MTQ-G56598, Peel I., CCW, IF, PRM, 2003; MTQ-G58456, Peel I., CCW, IF, PRM, 2005; MTQ-G57816–17, Peel I., PLH, 1991; MTQ-G59239, Green I., PLH, 1991; MTQ-G60171, Peel I., H. Fukami, 2007; MTQ-G60167, Goat I.,

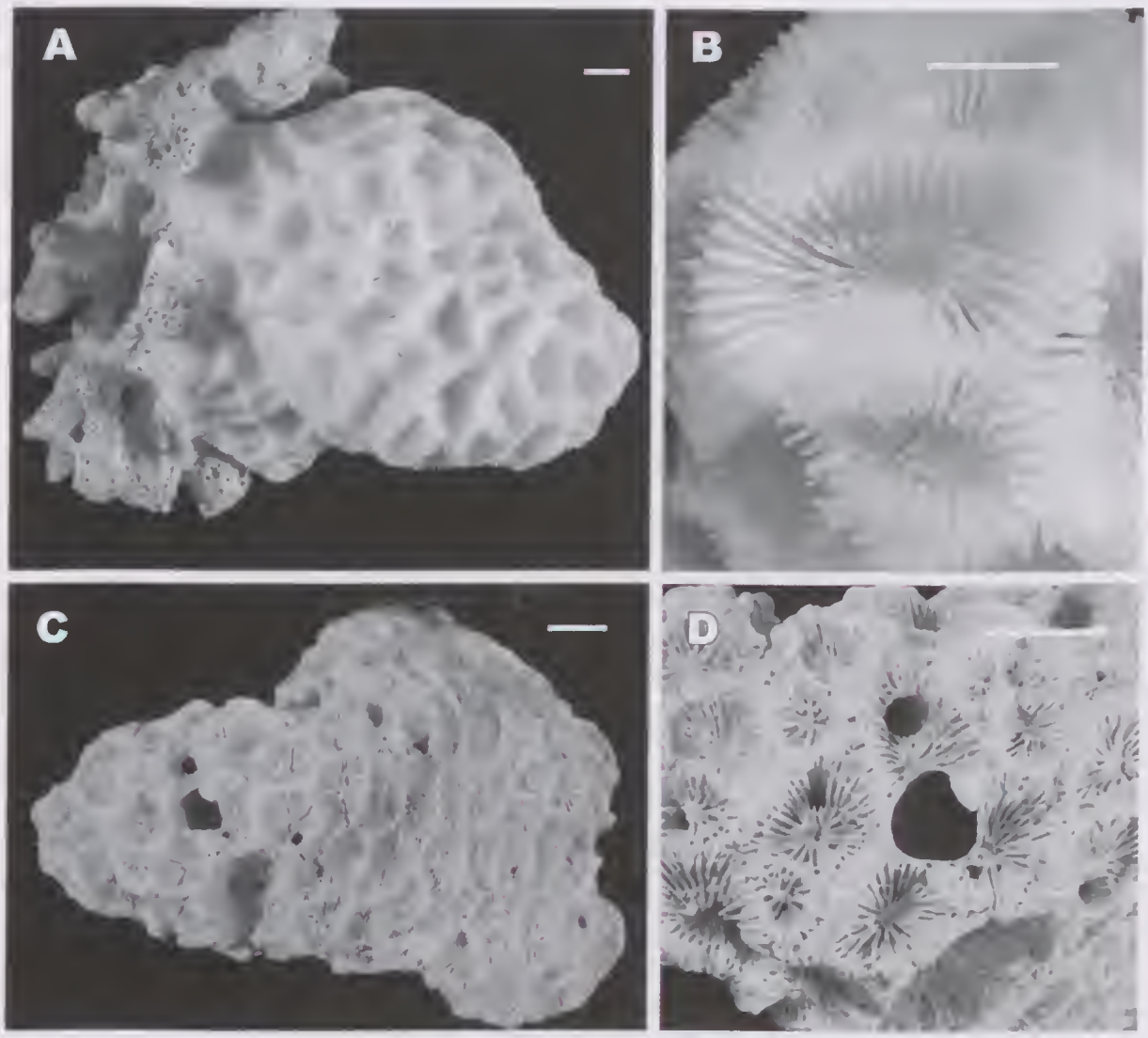

FIG. 41. *Favites halicora*: A, B, from Peel Island (MTQ-G56525); C, D, fossil from Bird-Goat Island (QM-G2020). A, C, whole colony. B, D, close-up of part of colony. Scale bars: A, C, D = 10 mm; B = 5 mm.

CCW, PRM, 2007; MTQ-G58453, Goat I., CCW , IF, PRM, 2005; MTQ-G60168–69, Myora, H. Fukami, 2007; MTQ-G57826, Moreton Bay, PLH, 1992; MTQ-G61510, Moreton Bay, H. Fukami, 2007; QM-G7316, Peel I., E. Lovell, 1972; QM-G7030, G7268, Peel I., E. Lovell, 1973. *Fossil Moreton Bay*: MTQ-G55323, Empire Point, CCW, IF, PRM, 2005; QM-'013', '020', Moreton Bay. *Living outside Bay*: MTQ-G55322, Shag Rock, CCW, IF, PRM, 2005; MTQ-G60170, Shag Rock, H. Fukami, 2007; Flinders Reef, visual record CCW, IF, 2005.

Skeletal Characteristics. Corallum massive, hemispherical and cerioid. Corallites on top of colony much smaller and shallower than those on sides. Corallite walls angular, calices 6–12 mm greatest diameter, 3–10 mm deep. Septa

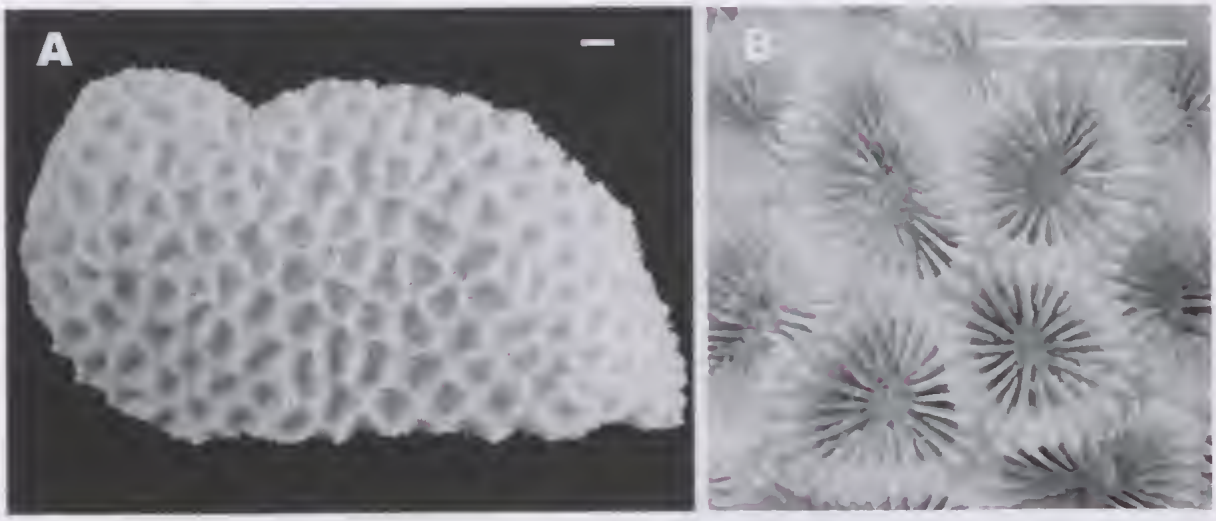

FIG. 42. *Favites chinensis* from Wellington Point (MTQ-G57484). A, whole colony; B, close-up of part of colony. Scale bars: 10 mm.

26–53, primary and secondary septa reaching to columella, S1=S2>S3>S4; septa exsert, with granulated sides and numerous fine teeth on tops and on axial edges; not continuous across corallite walls; paliform crown sometimes discernable, but never well developed in Moreton Bay specimens. Columella a twisted trabecular tangle in a small pit.

Field Characteristics. Moreton Bay specimens are mostly less than 200 mm diameter. Many are around 150 mm and have a hollow underneath probably due to excavation and occupation by the crab *Actumnus setifer* (see Johnson *et al.* 2008). Colour is pale brown or greenish brown.

Distribution. Indo-Pacific from East Africa and Red Sea to the central Pacific. East Australia: Great Barrier Reef south to Moreton Bay region.

Remarks. This species is first recorded from the bay by Harrison & Veron (1993) but the Lovell specimens indicate that it was present much earlier, and the fossil specimens may indicate a long history within the bay. The specimens show the growth form noted by Veron *et al.* (1977) as typical of fringing reefs, in that the paliform crown is hardly visible and the corallites are deeper than in other environments.

Further Literature. Veron *et al.* (1977); Harrison & Veron (1993); Veron (2000).

Goniastrea australensis (Haime & Milne Edwards, 1857) (Figs 6C, 44)

Prionastraea australensis Haime & Milne Edwards, 1857: 520. [Type locality: Australia].
Goniastrea benhami Vaughan, 1918: 116.

Material Examined. TYPE (*Prionastraea australensis*): MNHN-unnumbered (photograph by F. Benzoni and M. Pichon). *Living Moreton Bay*: MTQ-G56526, G56597, G58455, Peel I., IF, 2001; MTQ-G57829–30, Peel I., PLH, 1991; MTQ-G 59214, Peel I., PLH, 1991?; MTQ-G60172–73, Myora, H. Fukami, 2007; MTQ-G60174, Goat I. H. Fukami, 2007; QM-GBRC386, Peel I., C. Hedley, 1924; QM-G7002, Peel I., E. Lovell, 1971. *Fossil Moreton Bay*: MTQ-G58457, Mud I., IF, 2004; MTQ-G58487, Mud I., CCW, IF, PRM, 2005; MTQ-G58458–59, Empire Point, CCW, IF, PRM, 2005; QM-F12390, '026', Moreton Bay, University of Queensland Moreton Bay Collection. *Living outside Bay*: MTQ-G58454, Shag Rock, IF, 2005; Flinders Reef, visual record CCW, IF, 2005. *Further south*: recorded to South West Rocks, NSW (Harriott *et al.* 1999).

Skeletal Characteristics. Corallum massive, hemispherical to irregular, meandroid. Valleys

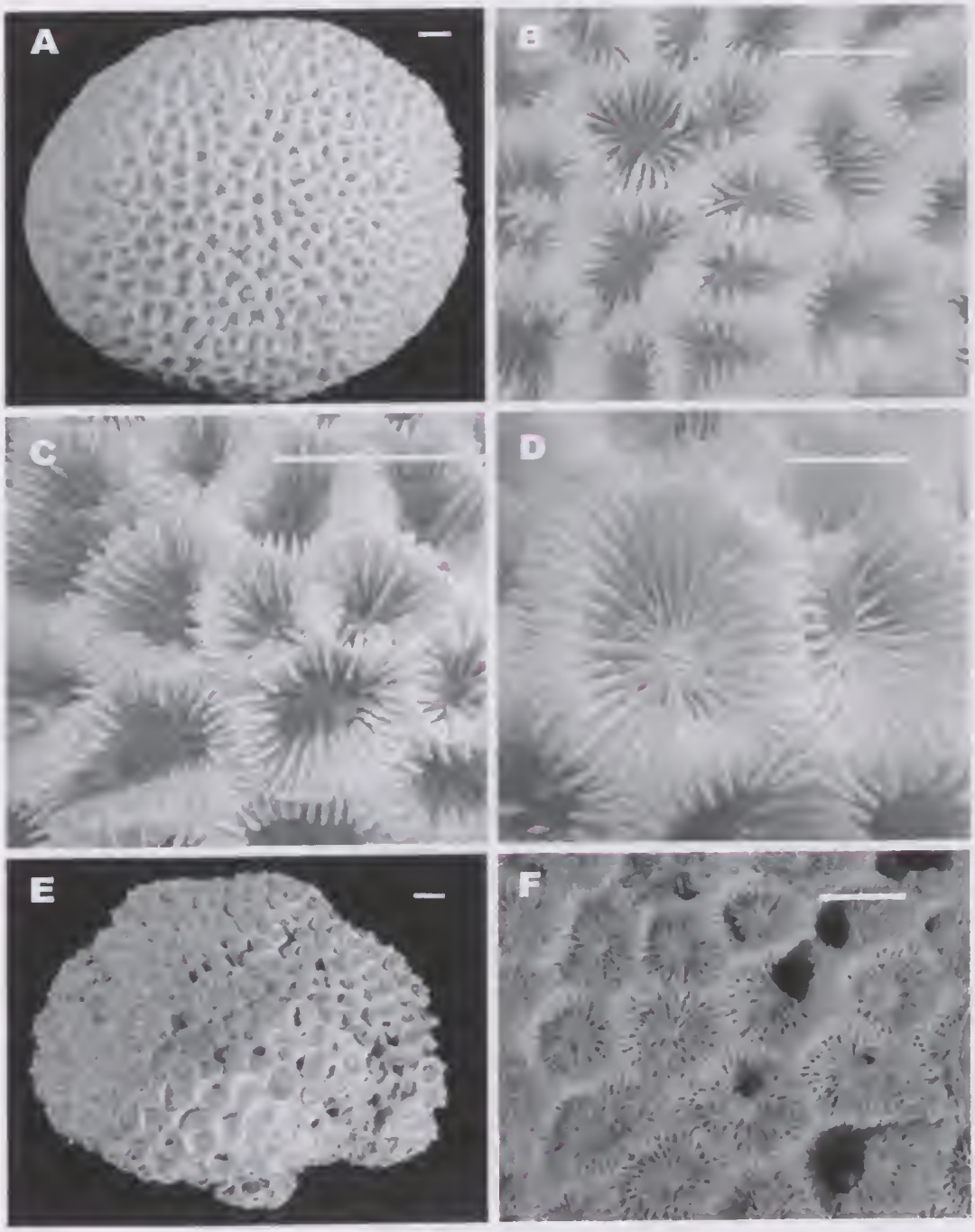

FIG. 43. *Goniastrea aspera*: A, B, C, D, from Peel Island (MTQ-G56527); E, F, fossil from Empire Point (MTQ-G55323). A, E, whole colony; B, C, D, F, close-up of part of colony. Scale bars: A, B, C, E, F = 10 mm; D = 5 mm.

have numerous well defined centres; width of valleys 5.5–8.5 mm; depths 4.0–8.5 mm. Septa equal in width, not exsert; neatly arranged and dropping deep into the corallite; mostly extending across top of wall. Septa and paliform lobes finely dentate. Columella a large, flat, dense reticulate arrangement.

Field Characteristics. Colonies to about 300 mm diameter. Colour pale brown.

Distribution. Indo-Pacific from East Africa and Red Sea to central Pacific. East Australia: Great Barrier Reef south to Lord Howe Island, NSW (Harriott *et al.* 1995).

Remarks. This species is well established in Moreton Bay, with specimens in the collection from 1924 onwards, and it is a common member of the fossil assemblage. Growth rates averaging 5.6 mm per year were estimated for *G. australensis* colonies at Peel Island (Roberts & Harriott 2003). This is higher than growth rates recorded for the same species in the tropics and it was concluded that 'recent environmental conditions in the region are good for coral growth' (Roberts & Harriott, 2003). *Goniastrea australensis* is the most southerly extending species in the genus, being recorded as far south as Forster, and Lord Howe Island, NSW.

Further Literature. Banks & Harriott (1995); Harriott (1995, 1999); Wilson & Harrison (1997, 2003); Roberts & Harriott (2003).

Goniastrea palauensis (Yabe, Sugiyama & Eguchi, 1936) (Fig. 45)

Favia palauensis Yabe, Sugiyama & Eguchi, 1936: 30, pl. 19, figs 5–6. [Type locality: Palau, Micronesia].

Material Examined. *Living Moreton Bay*: MTQ-G57644, Peel I., PLH, 1991; MTQ-G59222, Peel I., PLH, 1991?; MTQ-G61493, Peel I., PLH, 1992; MTQ-G58482, Peel I., PLH, 1994?; MTQ-G58464, Goat I., PLH, IF, 2005. *Fossil Moreton Bay*: MTQ-G61527–28, Empire Point, CCW, IF, PRM, 2005. *Living outside Bay*: Flinders Reef, visual record IF, 2005. *Further south*: recorded to Cook I. (Harriott *et al.* 1999).

Skeletal Characteristics. Corallum massive, flattened or irregular. Corallites cerioid, with thick angular walls; diameters 8.0 to 14.0 mm and depths 3.0–7.5 mm. Septa in two sizes, one reaching the columella and the other reaching about halfway. Septa mostly continuous across wall and with numerous very fine teeth. Columellae a small to large tangle of basal septal denticles.

Field Characteristics. Low spreading massive colonies with corallites larger than those of other *Goniastrea*. Colour grey, brown or green.

Distribution. Indo-Pacific from East Africa to Eastern Australia to the central Pacific. East Australia: Great Barrier Reef south to Cook Island, northern NSW (Harriott *et al.* 1999).

Remarks. Although not recorded in the older literature, this species is not uncommon in the bay and is well represented in the fossil record.

Further Literature. Veron *et al.* (1977); Banks & Harriott (1995); Veron (2000).

Goniastrea pectinata (Ehrenberg, 1834) (Fig. 46)

Astrea pectinata Ehrenberg, 1834: 320. [Type locality: Red Sea].
Astrea favistella Dana, 1846: 241, pl. 13, fig. 2.
Astrea sinuosa Dana, 1846: 243, pl. 13, fig. 5.
Astrea cerium Dana, 1846: 245, pl. 13, fig. 8.
Goniastrea planulata Milne Edwards & Haime, 1850: 162.
Goniastrea quoyi Milne Edwards and Haime, 1850: 162.
Goniastrea grayi Milne Edwards and Haime, 1850: 163.
Goniastrea coronalis Quelch, 1886:101, pl. 3, figs 3–3a.
Goniastrea columella Crossland, 1948: 191, pl. 8, pl. 10 (upper).

Material Examined. *Living Moreton Bay*: MTQ-G58479–81, Goat I., CCW, IF, PRM, 2005; MTQ-G57831, Moreton Bay, PLH, 1993. *Living outside Bay*: QM-G7347, Flinders Reef, B. Stablum, 1972.

Skeletal Characteristics. Corallum low massive or encrusting, corallites monocentric to sub-meandroid (up to three centres). Mature monocentric corallites 5–11 mm in diameter; wall thick. Septa in two sizes, dentate with sides strongly granulated. Columella a dense tangle of trabeculae.

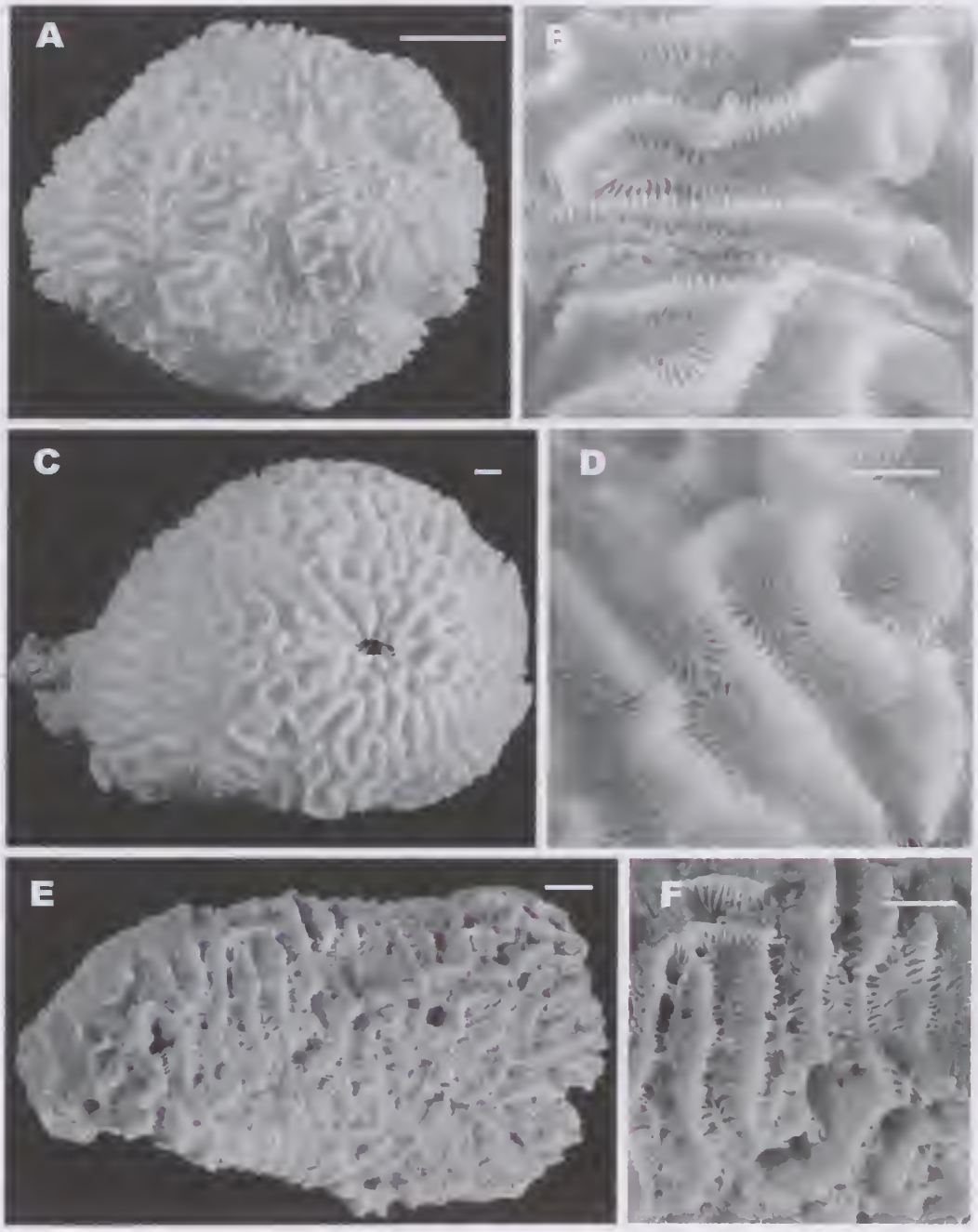

FIG. 44. *Goniastrea australensis*: A, B, from Peel Island (MTQ-G56597); C, D, from Peel Island (MTQ-G56526); E, F, fossil from Empire Point (MTQ-G58459). A, C, E, whole colony. B, D, F, close-up of part of colony. Scale bars: A = 50 mm; B, D, F = 5 mm; C, E = 10 mm.

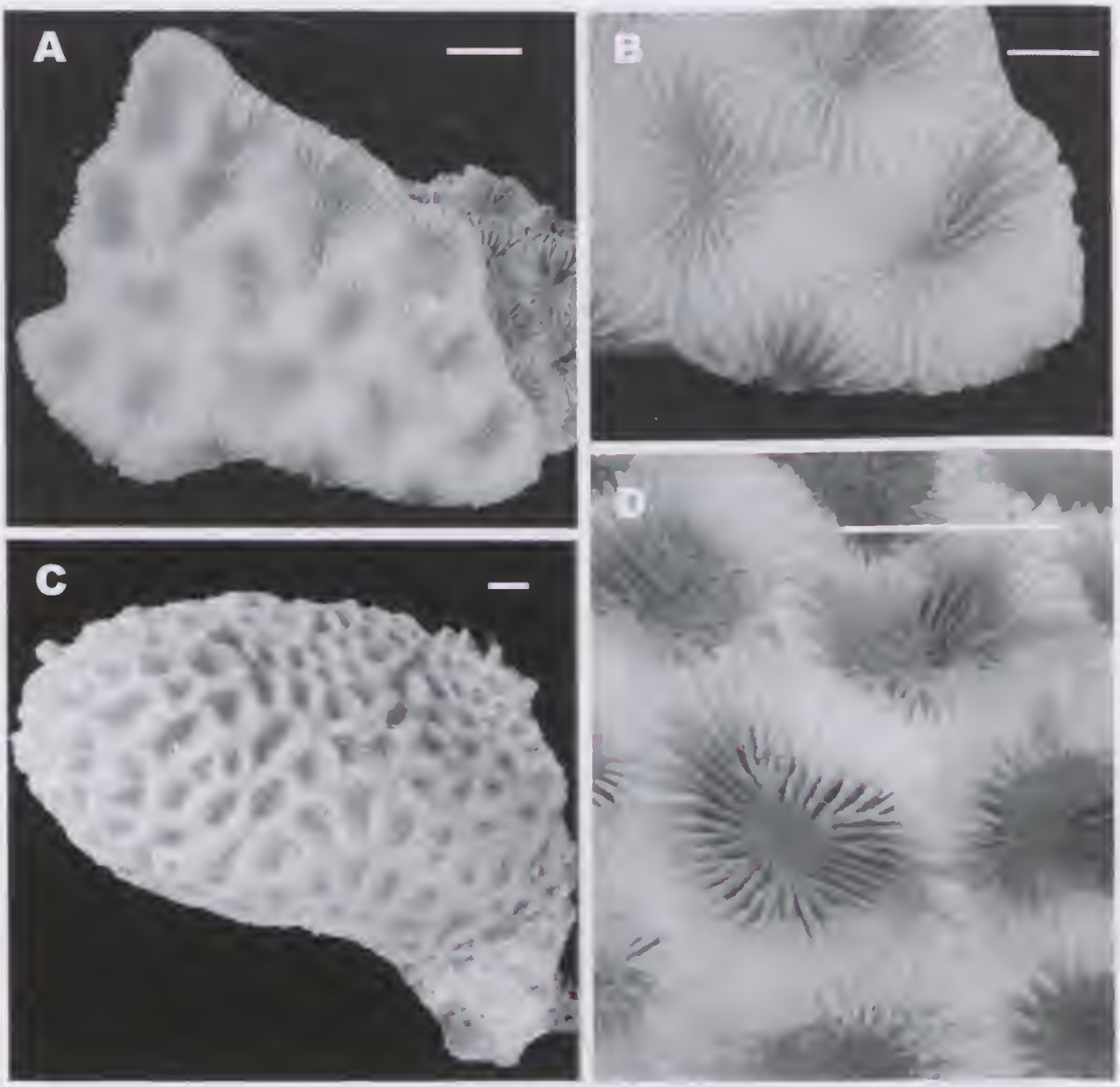

FIG. 45. *Goniastrea palauensis*: A, B, from Peel Island (MTQ-G59222); C, D, from Peel Island (MTQ-G58482). A, C, whole colony; B, D, close-up of part of colony. Scale bars: 10mm.

Field Characteristics. The colonies seen were all less than 200 mm in diameter. Colour pale brown.

Distribution. Widespread Indo-Pacific from East Africa and Red Sea to Pitcairn Islands. East Australia: Great Barrier Reef south to Solitary Islands, NSW.

Remarks. This is the first record of *Goniastrea pectinata* from Moreton Bay. Its restriction to Goat Island (and one other unrecorded locality,

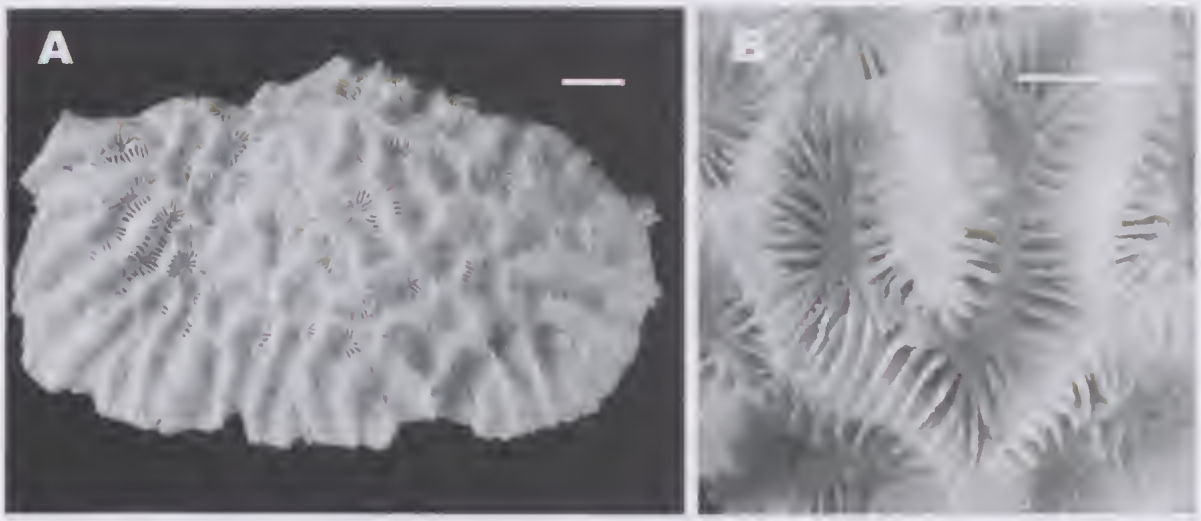

FIG. 46. *Goniastrea pectinata* from Moreton Bay (MTQ-G57831). A, whole colony. B, close-up of part of colony. Scale bars: A = 10 mm; B = 5 mm.

most likely to be near Peel Island) indicates that the species could have recently recruited from outside the bay.

Further Literature. Wijsman-Best (1972); Veron *et al.* (1977); Harriott *et al.* (1994); Veron (2000).

Oulophyllia Milne Edwards & Haime, 1848

Type species. *Oulophyllia crispa* (Lamarck, 1816).

Diagnosis. Colonies meandroid and usually massive, formed by intramural polystomodeal budding. Series short, discontinuous, separated by simple, acute, parathecal collines, centres linked by trabeculae. Endo- and exothecal dissepiments vesicular. Columella trabecular and spongy. *Mid Oligocene to Recent.*

Oulophyllia crispa (Lamarck, 1816) (Figs 6F, 47)

Meandrina crispa Lamarck, 1816: 247. [Type locality: Indian Ocean].
Ulophyllia aspera Quelch, 1886: 88, pl. 3, figs 5, 5b.
Ulophyllia stuhlmanni Rehberg, 1892: 17.
Coeloria cooperi Gardiner, 1904: 762, pl. 60, fig. 9.
Coeloria magna Gardiner, 1904: 763, pl. 60, figs 7–8.
Ulophyllia bonhourei Gravier, 1910: 274.
Coeloria gigantea Yabe, Sugiyama & Eguchi, 1936:37, pls 22, 34.
Coelogyra levis Nemenzo, 1959: 109.

Material Examined. *Living Moreton Bay*: MTQ-G57822–23, Peel I, PLH, 1991. *Fossil Moreton Bay*: MTQ-G57470, Empire Point, CCW, IF, PRM, 2003; MTQ-G58461, Empire Point, CCW, IF, PRM, 2005. *Living outside Bay*: MTQ-G58462, Shag Rock, IF, 2005.

Skeletal Characteristics. Corallum massive, hemispherical, meandroid. Valleys up to 14 mm depth and 20 mm wide (10 mm in Moreton Bay specimens). Tops of valleys varying in height. Supporting collines frequent. Septa slightly exsert and ragged in appearance at top of walls, not continuous over walls; septa with numerous, irregular, small plate-like teeth. Columellae round trabecular tangles, connected by trabeculae between centres.

Field Characteristics. Hemispherical colonies, up to about 300 mm diameter. Colour pale brown.

Distribution. Widespread Indo-Pacific from East Africa and Red Sea to central Pacific. East Australia: Great Barrier Reef south to Moreton Bay region.

Remarks. Moreton Bay specimens of this species have small dimensions to corallite valleys, relative to those described for the species generally

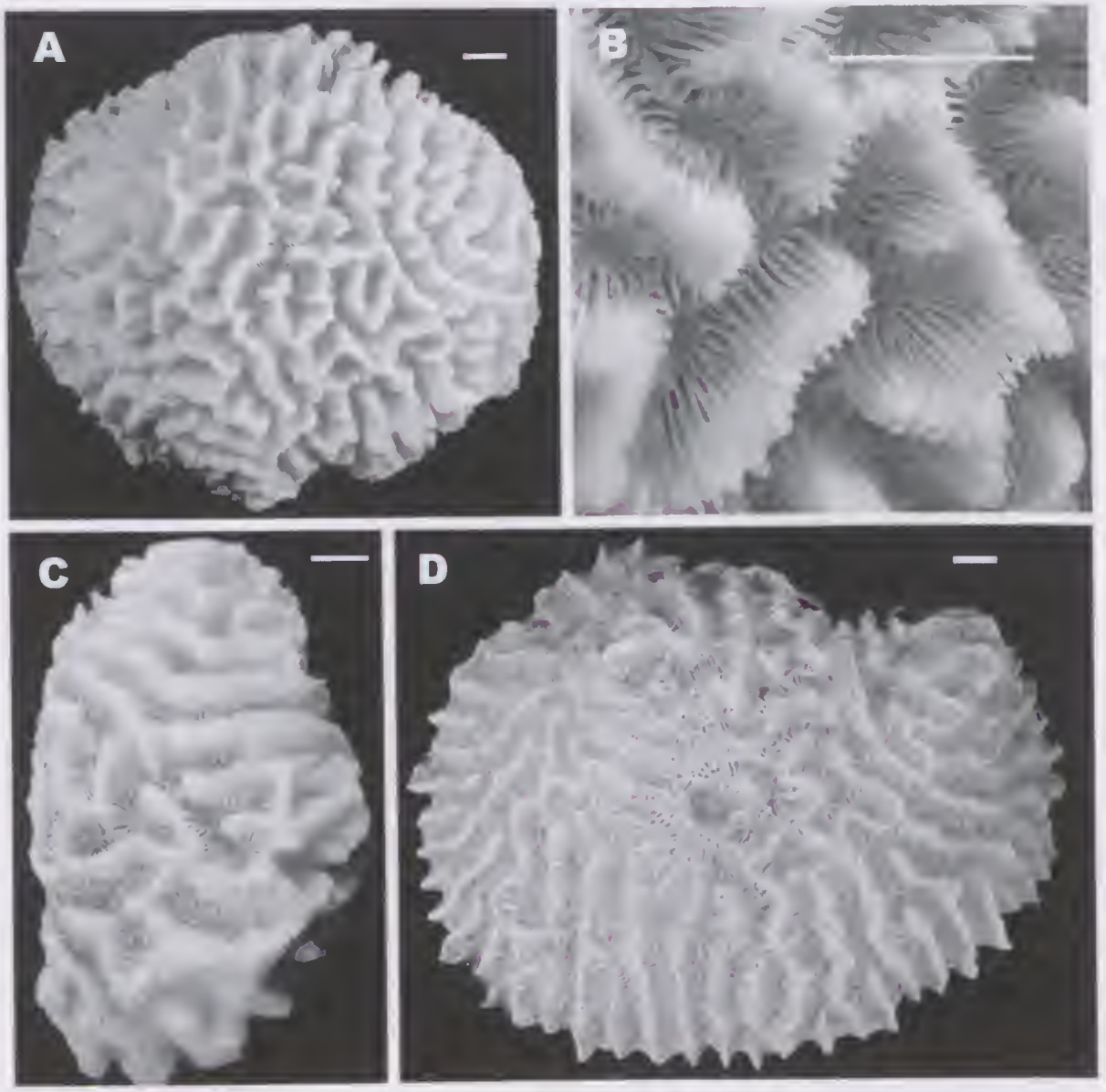

FIG. 47. *Oulophyllia crispa*: A, B, from Peel Island (MTQ-G57823); C, from Peel Island (MTQ-G57822); D, fossil from Empire Point (MTQ-G57470). A, C, D, whole colony; B, close-up of part of colony. Scale bars: 10 mm.

(Veron *et al.* 1977). Because of this, the species may sometimes be mistaken for *Platygyra*.

Further Literature. Wijsman-Best (1972); Banks & Harriott (1995); Veron *et al.* (1977); Veron (2000).

Platygyra Ehrenberg, 1834

Type species. *Platygyra lamellina* (Ehrenberg, 1834).

Diagnosis. Colonies meandroid; colony formation by linear intramural polystomodeal

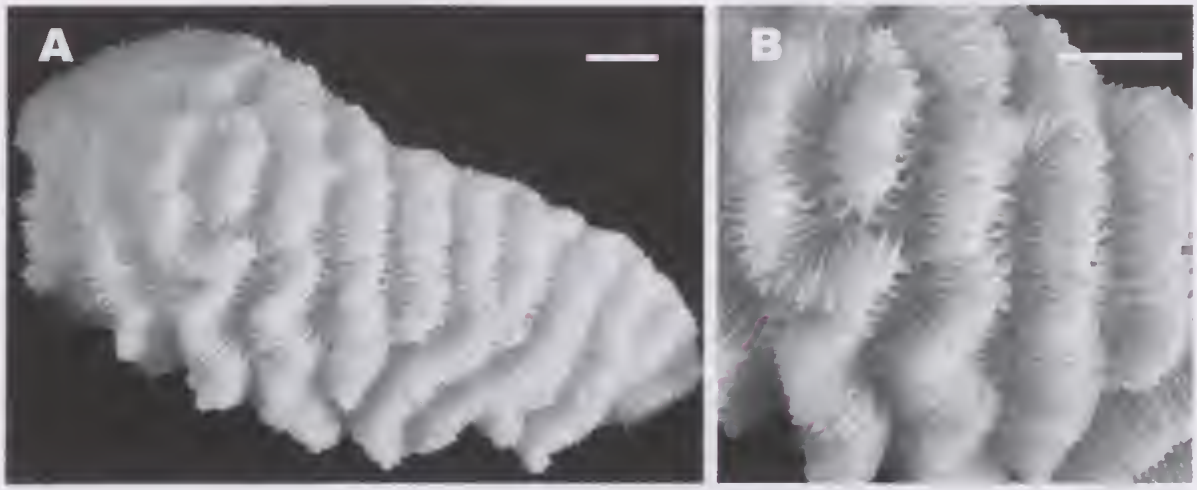

FIG. 48. *Platygyra lamellina* from Peel Island (MTQ-G58491). A, whole colony; B, close-up of part of colony. Scale bars: 10 mm.

budding with lateral branching and terminal forking; collines narrow, septothecal; larger septa commonly with small internal paliform lobes; columella continuous, trabecular. *Eocene to Recent*.

Platygyra lamellina (Ehrenberg, 1834) (Fig. 48)

Meandra lamellina Ehrenberg, 1834: 323–324. [Type locality: Red Sea].

Coeloria bottai Milne Edwards & Haime, 1849a: 295.

Coeloria laticollis Milne Edwards & Haime, 1849a: 295.

Coeloria subdentata Milne Edwards & Haime, 1849a: 296.

Coeloria forskaliana Milne Edwards & Haime, 1849a: 296.

Coeloria arabica Klunzinger, 1879: 15–19.

Material Examined. *Living Moreton Bay*: MTQ-G58491, Peel I. PLH, 1995. *Fossil Moreton Bay*: recorded as subfossil from Goat and Mud Islands by Wells (1955). *Living outside Bay*: Flinders Reef, recorded Veron (1993).

Skeletal Characteristics. Corallum massive, rounded. Valleys elongate, walls thick and may be swollen on top. Valley widths 4–10 mm. Septa mostly extend across the wall and are in two orders: the first reaches the columella, and the second ranges from absent to almost reaching the columella. No paliform lobes. Columella a continuous line of twisted basal septal teeth.

Field Characteristics. Massive colonies with meandroid corallites with thick walls. Colour brown with green valleys.

Distribution. Widespread Indo-Pacific from East Africa, Red Sea and Arabian Gulf to central Pacific. East Australia: Great Barrier Reef south to Moreton Bay and Solitary Islands (Harriott *et al.* 1994).

Remarks. Recorded as 'occasionally present' in living assemblages of Moreton Bay by Wells (1955) and apparently still occasionally present by 2007.

Further Literature. Wijsman-Best (1972); Lovell (1989); Veron *et al.* (1977); Veron (2000).

MONTASTREINAE Vaughan & Wells, 1943

Diagnosis. Colonial, hermatypic favids; colony formation by extra-tentacular budding; septa formed by one-fan system of mostly simple trabeculae.

Montastraea de Blainville, 1830

Type species. *Astrea guettardi* Defrance, 1826.

Diagnosis. Colonies massive, encrusting, or subfoleaceous; plocoid; corallite walls septothecate;

septal margins regularly dentate; columella trabecular. *Upper Jurassic to Recent.*

Montastraea curta (Dana, 1946)
(Figs 6G, 49)

Astrea (Orbicella) curta Dana, 1846: 206. [Type locality: Fiji]. [See synonymy in Veron *et al.*, 1977: 137].

Material Examined. SYNTYPE: USNM-14, Fiji, US Exploring Expedition. *Living Moreton Bay*: MTQ-G55320, Peel I., PLH, 1994; MTQ-G56528, Peel I., IF, 2002; MTQ-G56599, Peel I., CCW, IF, PRM, 2003; MTQ-G58449, Amity Rock Wall, CCW, IF, PRM, 2005. *Fossil Moreton Bay*: MTQ-G56600, Empire Point, CCW, IF, PRM, 2003. *Living outside Bay*: Flinders Reef, recorded Veron (1993). *Further south*: recorded to Solitary Is (Harriott *et al.* 1994, 1999).

Skeletal Characteristics. (from Moreton Bay specimens only, see Comments). Corallum submassive, irregular. Corallites round, or elongate in crowded areas, varying from widely spaced to crowded; corallites greatest diameter 5.5–12 mm (4–6 mm in type), depth 3–9 mm. Septa 30–46 (38 to 52 in type), first and second cycles reaching the columella, S1=S2>S3>S4; septa exsert, first and second cycles higher; sometimes swollen; with numerous small teeth, paliform lobes insignificant, or developed in shallowest corallites. Columella a descending tangle of basal septal teeth, forming a deep pit. Coenosteum, where visible, with some blistering and teeth.

Characteristics of Type. Club shaped massive, corallites round to oval, diameter 4–6 mm, depth 1.5–2.0 mm. Septa 38–52, several long and slender teeth, branched at tips. Paliform crown present. Columella a very small trabecular tangle. Costae swollen.

Field Characteristics. Colonies up to 300 mm in diameter. Colour pale brown.

Distribution. Widespread Indo-Pacific. East Australia: Great Barrier Reef to Solitary Islands, northern NSW (Harriott *et al.* 1994, 1999).

Remarks. The Moreton Bay material differs from the type of *M. curta* in several respects, including: corallites significantly larger and deeper, septa in two orders rather than three, septal teeth smaller and more numerous and not branched at tip; and columella larger and different in structure. We have followed the conclusions of Veron *et al.* (1977) in identifying this species, as the material from Moreton Bay agrees with their description of '*Montastrea curta* from protected and semi-protected biotopes'; however, we suspect that this may be a separate species.

Further Literature. Harriott *et al.* (1994, 1999); Veron *et al.* (1977); Wilson & Harrison (1997, 2003); Veron (2000).

Plesiastrea Milne Edwards & Haime, 1848

Type species. *Plesiastrea versipora* Lamarck, 1816.

Diagnosis. Colony massive or encrusting, plocoid with corallites closely united nearly to their summits; colony formation by extra-tentacular budding. *Miocene to Recent.*

Plesiastrea versipora (Lamarck, 1816)
(Figs 6A, 50)

Astraea versipora Lamarck, 1816, tome 2: 264. [Type locality: Indian Ocean].
Plesiastrea urvillei Milne Edwards & Haime, 1850: 117.
Plesiastrea quatrefagiana Milne Edwards & Haime, 1850: 119.
Plesiastrea peroni Haime & Milne Edwards, 1857: 492.
Plesiatrea proximans Dennant, 1904: 9, pl. 2, figs 3a–b.
Favia ingolfi Crossland, 1931: 384, pls 15–19, fig. 32.
Plesiastrea salebrosa Nemenzo, 1959: 92–93, pl. 1 fig. 2.

Material Examined. *Living Moreton Bay*: MTQ-G58396, Peel I., CCW, IF, PRM, 2005; MTQ-G60100, Peel I., H. Fukami, 2007; MTQ-G58450, Goat I., CCW, IF, PRM, 2005; QM-G7332, Peel I., E. Lovell, 1972. *Fossil Moreton Bay*: recorded as subfossil from Mud I. by Wells (1955). *Living outside Bay*: QM-G7261–63, Flinders Reef, E. Lovell, 1973. *Further south*: recorded to southern Victoria (Veron 1993; and other sources).

Skeletal Characteristics. Corallum hemispherical or encrusting. Corallites round, oval or with angular walls exsert and very close together, diameter 2.5 to 4.0 mm, septa 34–36, S1=S2>S3>S4; septa with moderately to strongly granulated sides and pali forming a paliform ring which varies from very distinct to absent (sometimes in a single

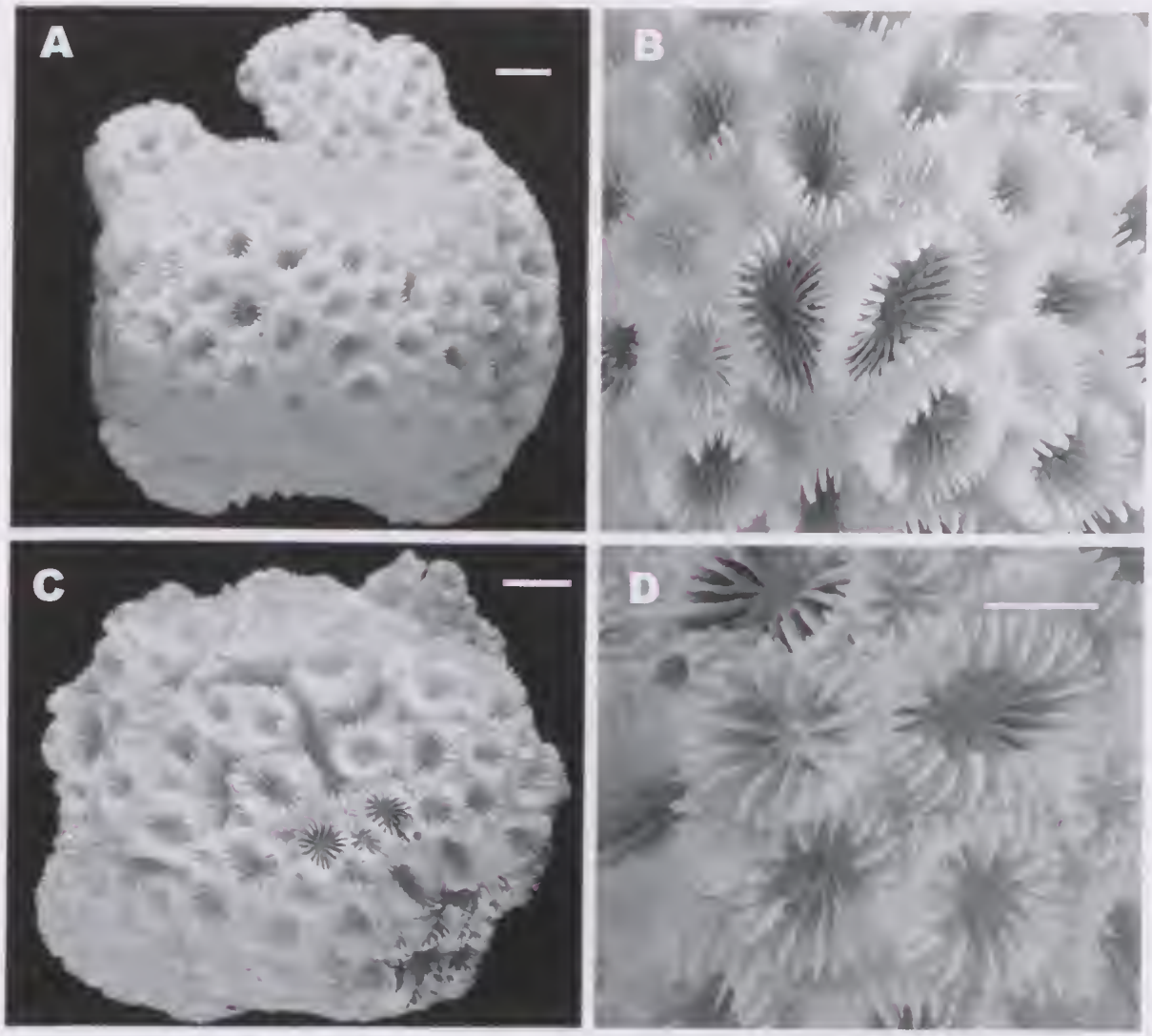

FIG. 49. *Montastraea curta*: A, B, from Peel Island (MTQ-G56599); C, D, from Peel Island (MTQ-G56528). A, C, whole colony; B, D, close-up of part of colony. Scale bars: 10 mm.

corallum). Coenosteum very limited because of the crowded corallites. Costae extend beyond the corallite walls but are not continuous.

Field Characteristics. Smooth or irregular hemispherical colonies. Colour pale brown or bright green.

Distribution. Widespread Indo-Pacific from East Africa, Red Sea and Arabian Gulf to Pitcairn Islands. East Australia: Great Barrier Reef south to southern Victoria.

Remarks. This is one of the few truly temperate species of zooxanthellate corals, reaching great abundance in Sydney Harbour, and extending around the Australian coastline. Records of *Favia stelligera* in Moreton Bay are probably of this species. It is known as a very variable

species (Veron *et al.* 1977), but most of the variability is in microscopic features of the corallites and the species is distinctive because of its small and closely arranged corallites.

Further Literature. Lovell (1989); Veron *et al.* (1977, 1993); Veron (2000).

Cyphastrea Milne Edwards & Haime, 1848

Type species. *Cyphastrea microphthalma* (Lamarck, 1816).

Diagnosis. Colonies massive, encrusting, or sub-foleaceous. Corallites plocoid, septothecate; septal margins regularly dentate; columella trabecular. Coenosteum surface spinose; costae rarely extending into coenosteum. *Oligocene to Recent.*

Cyphastrea serailia (Forskål, 1775) (Figs 6E, 51)

Madrepora serailia Forskål, 1775: 135. [Type locality: Red Sea].
Cyphastrea danai Haime & Milne Edwards, 1857: 487.

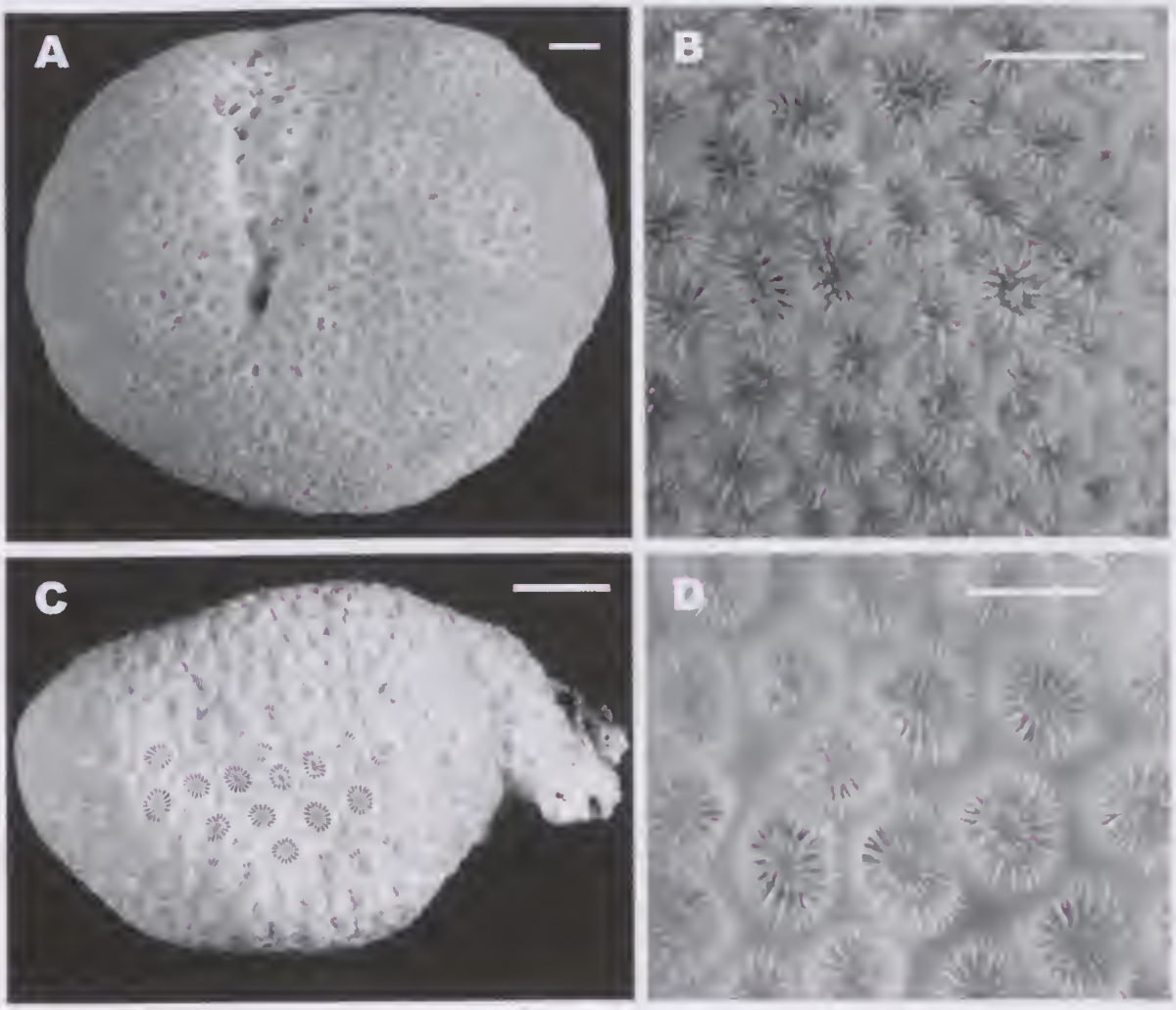

FIG. 50. *Plesiastraea versipora*: A, B, from Peel Island (MTQ-G7332); C, D, from Peel Island (MTQ-G56529). A, C, whole colony; B, D, close-up of part of colony. Scale bars: A, C = 10 mm; B, D = 5 mm.

Cyphastrea brueggemanni Quelch, 1886: 107, pl. 4, figs 4–4a.
Cyphastrea suvadivae Gardiner, 1904: 780.
Cyphastrea conferta Nemenzo, 1959: 116, pl. 15, fig. 1.

Material Examined. *Living Moreton Bay*: MTQ-G56530, G56549, Peel I, IF, 2001; MTQ-G59220, Peel I., PLH, 1994; MTQ-G56593, Peel I., CCW, IF, PRM, 2003; MTQ-G59209, Peel I., CCW, IF, PRM, 2005; MTQ-G57820, Peel I., PLH, 1992; MTQ-G57821, Peel I., PLH, 1994; MTQ-G58447, Empire Point, PLH, 1991; MTQ-G58448, Wellington Point, PLH, 1991; QM-G2021, Goat I, Science Students Association, 1938; QM-G2774, Myora, J.W. Wells, 1950; QM-G6647, G5888–89, Green I., M. Dredge, 1971; QM-G6992, G6995, G7019, Peel I., E. Lovell, 1972; QM-G7811, Green I., C. Limpus, 1974. *Fossil Moreton Bay*: MTQ-G56595, G56602–03, Mud I., CCW, IF, PRM, 2003; MTQ-G56596, Empire Point, CCW, IF, PRM, 2003; MTQ-G58446, Mud I., CCW, IF, PRM, 2005; MTQ-G56602–03, Mud I., CCW, IF, PRM, 2003; MTQ-G58444–46, Mud I., CCW, IF, PRM, 2005; recorded as subfossil from Goat and Mud Is by Wells (1955). *Living outside Bay*: QM-G7321, Flinders Reef, E. Lovell, 1972; Flinders Reef, visual record IF, 2005. *Further south*: recorded to Solitary Is (Harriott *et al.* 1999).

Skeletal Characteristics. Corallum massive, with smooth or irregular surface, up to 600 mm in diameter. Corallites circular, 2.5–2.8 mm diameter. Septa 24, S1=S2>S3; costae (see detail Veron *et al.* 1976); paliform crown usually present. Costae extend to base of corallite wall. Coenosteum blistered, with scattered spinules.

Field Characteristics. Occurs in colonies of irregular massive structure as well as coroliths (unattached, smooth rounded or egg-shaped colonies with corallite development on all surfaces). The small, round, exsert corallites separated by coenosteum are distinctive. Colour pale brown or bright green.

Distribution. Widespread Indo-Pacific from East Africa, Red Sea and Arabian Gulf to Pitcairn Islands. East Australia: Great Barrier Reef south to Lord Howe Island, NSW.

Remarks. There is good evidence that *Cyphastrea serailia* populations have been continuously present on Moreton Bay reefs. The species is represented in collections throughout most of the twentieth century. The specimens include some coraliths or 'coral balls', usually formed in response to regular strong tidal water movement in alternating directions. *Cyphastrea serailia* was the first species observed to spawn in Moreton Bay — 8–9 nights after the full moon in December 1992, and again in January 1994 (Harrison 1993; Harrison *et al.* 1998). Colonies from Peel Island and Wellington Point had average growth rates of 7.2 and 10.4 mm per year respectively (Roberts & Harriott 2003), the fastest coral growth rates measured to date from Moreton Bay corals. This species is also abundant in the fossil record of the bay.

Further Literature. Veron *et al.* (1977); Lovell (1989); Harrison (1993); Harriott *et al.* (1995, 1999); Wilson & Harrison (1997, 2003); Roberts & Harriott (2003); Harrison *et al.* (1998); Veron (2000).

MERULINIDAE Verrill, 1866

Diagnosis. Colonial, hermatypic; colony formation by intra-tentacular polystomodeal budding; centres linked by trabeculae; septa of one-fan system of compound trabeculae; dentate; columella feeble or absent; dissepiments sparse. (From Wells 1956).

Hydnophora Fischer de Waldheim, 1807

Type species. *Hydnophora exesa* (Pallas, 1766).

Diagnosis. Hydnophoroid: colony formation by circum-mural polystomodeal budding, through which stomodea become arranged around discontinuous collines (protuberant pieces of corallite surface); columella trabecular to laminar, discontinuous. *Cretaceous to Recent.*

Hydnophora exesa (Pallas, 1766) (Figs 8E, 52)

Madrepora exesa Pallas, 1766: 290. [Type locality: 'Indian Ocean'].
Hydnophora contignatio Forskål, 1775: 134.
Hydnophora demidovii Fischer de Waldheim, 1807: 295–296.
Monticularia lobata Lamarck, 1816: 392–394.
Monticularia polygonata Lamarck, 1816: 392–394.
Monticularia meandrina Lamarck, 1816: 392–394.

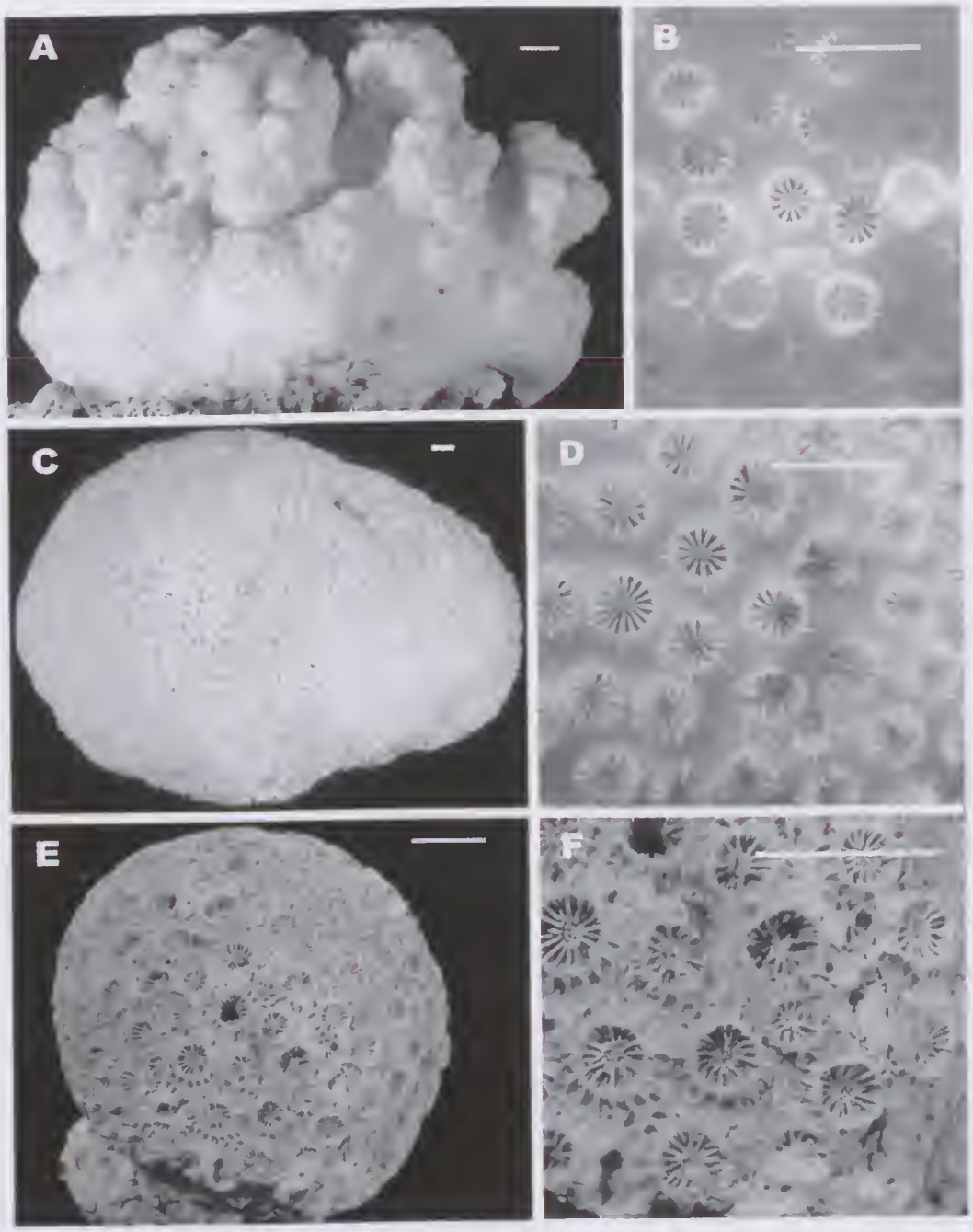

FIG. 51. *Cyphastrea serailia*: A, B, from Peel Island (MTQ-G56549); C, D, from Peel Island (MTQ-G56530); E, F, fossil from Moreton Bay (QM unregistered, temporary no. 008). A, C, E, whole colony; B, D, F, close-up of part of colony. Scale bars: A, C, E = 10 mm; B, D, F = 5 mm.

Monticularia folium Lamarck, 1816: 392–394.
Hydnophora gyrosa Milne Edwards & Haime, 1849a: 303.
Hydnophora ehrenbergi Milne Edwards & Haime, 1849a: 304.
Hydnophora tenella Quelch, 1886: 96, pl. 5, figs 8–8a.
Hydnophora maldivensis Gardiner, 1904: 765, pl. 60, fig. 12.

Material Examined. *Living Moreton Bay*: MTQ-G56568, Myora, CCW, IF, PRM, 2003. *Fossil Moreton Bay*: QM: '009', '0010', Moreton Bay (University of Queensland collection); recorded as subfossil from Mud I. by Wells (1955). *Living outside Bay*: QM-G7021, Finders Reef, E. Lovell, 1971; MTQ-G58451, Flat Rock, CCW, IF, PRM, 2005; Flinders Reef, recorded CCW, IF, 2005. *Further south*: recorded to Solitary Is (Harriott *et al.* 1999).

Skeletal Characteristics. Corallum submassive and with thick branching columns in the centre, surrounded by encrusting areas. Corallite centres very difficult to discern and columella absent. Coenosteal collines 5–8 mm diameter.

Field Appearance. Colonies attain around 1 m in diameter and 500 mm tall. The polyps are often extended by day. Colour grey or pale green.

Distribution. Widespread Indo-Pacific. East Australia: Great Barrier Reef to Lord Howe Island, NSW.

Remarks. Although not abundant, this species appears to have well established populations at Myora, and is reported from Green Island (Lovell 1989).

Further Literature. Veron *et al.* (1977); Lovell (1989); Harriott *et al.* (1995); Veron (2000).

MUSSIDAE Ortmann, 1890

Diagnosis. Solitary and colonial, hermatypic. Colony formation by intratentacular budding; centres linked by lamellae or trabeculae. Septothecate or parathecate. Septa entocoelic, formed by several fan systems of large, simple trabeculae, each fan system producing a lobulate dentation. Endothecal dissepiments well developed. Columella trabecular. *?Upper Jurassic; Eocene to Recent.*

Remarks. As mentioned in the Introduction, current Indo-Pacific members of this family will no longer be regarded as mussids, as membership of this family will be limited to Atlantic members following the publication of Budd *et al.* (in press).

Lobophyllia de Blainville, 1830

Type species. *Madrepora corymbosa* Forskål, 1775.

Diagnosis. Phaceloid to meandroid colonies formed by intramural polystomodeal budding, series laterally free. Centres with lamellar linkage. *Recent.*

Lobophyllia corymbosa (Forskål, 1775) (Figs 7G, 53)

Madrepora corymbosa Forskål, 1775: 137. [Type locality: Red Sea].
Mussa cactus Dana, 1846:178, figs 1, 1a–c.
Lobophyllia rudis Milne Edwards & Haime, 1849a: 245.
Lobophyllia eydouxi Milne Edwards & Haime, 1849a: 246.
Lobophyllia ringens Milne Edwards & Haime, 1849a: 247.
Lobophyllia fistulosa Milne Edwards & Haime, 1849a: 247.
Mussa glomerata Haime & Milne Edwards, 1857: 331.
Mussa aspera Haime & Milne Edwards, 1857: 332.

Material Examined. *Living Moreton Bay*: MTQ-G56584–85, Peel I., CCW, IF, PRM, 2003. *Fossil Moreton Bay*: MTQ-G56577–80, Empire Point, CCW, IF, PRM, 2003; MTQ-G58883, G58955, Empire Point, CCW, IF, PRM, 2005; MTQ-G56581–83, Mud I., CCW, IF, PRM, 2003; MTQ-G58553, G58956, Mud I., CCW, IF, PRM, 2005; QM-G2026, Goat I., Science Students Association, 1938; UQ Collection temporary no. 016, Moreton Bay. *Living outside Bay*: Flinders Reef, recorded Veron (1993).

Skeletal Characteristics. Hemispherical colonies with corallites mono- to tricentric. Corallites plocoid with well developed wall; calice diameter 2–3 mm in monocentric corallites, depth of calice 13–20 mm. Septa S1≈S2>S3>S4 first cycle septa thicker, dentations large, increasing towards base of corallite. Columella trabecular, dense or diffuse.

Field Characteristics. Colonies growing to about 1 m in diameter, with large plocoid corallites with prominent teeth and fleshy polyp tissues visible. Colour grey or yellow.

Distribution. Indo-Pacific from East Africa and Red Sea to French Polynesia. East Australia: Great Barrier Reef south to Moreton Bay region.

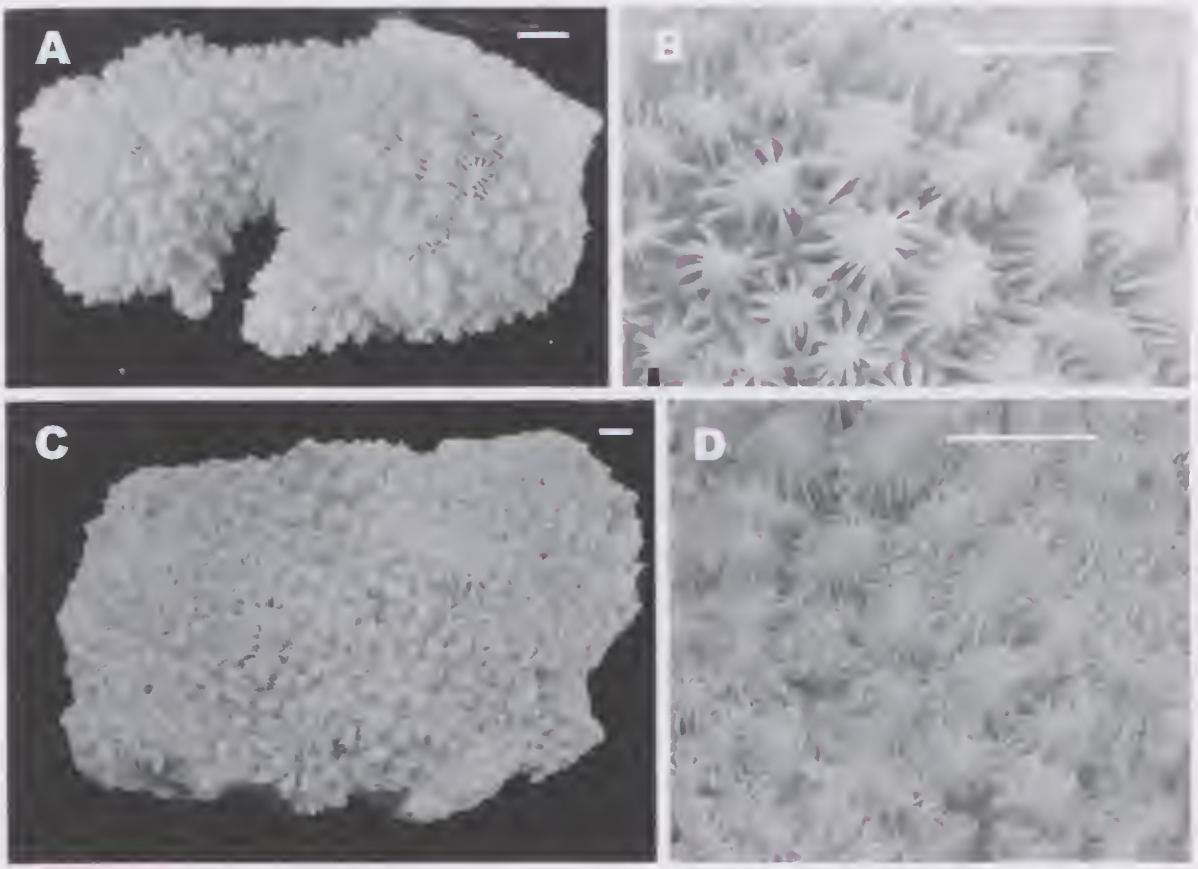

FIG. 52. *Hydnophora exesa*: A, B, from Myora (MTQ-G56568); C, D, fossil from Moreton Bay (QM unregistered, temporary no. 009). A, C, portion of colony; B, D, close-up. Scale bars: 10 mm.

Remarks. This widespread and easily recognised species is not abundant in the bay, but fossil material appears to indicate previous more abundant distribution.

Further Literature. Wells (1956); Chevalier (1975); Veron & Pichon (1980); Lovell (1989); Sheppard & Sheppard (1991); Nishihira & Veron (1995); Veron (2000).

Acanthastrea Milne Edwards & Haime, 1848

Type species. *Acanthastrea spinosa* Milne Edwards & Haime, 1848 (= *Astrea echinata* Dana, 1846).

Diagnosis. Cerioid (rarely plocoid) colonies with monocentric corallites formed mostly by marginal budding. *Miocene to Recent.*

Remarks. In Moreton Bay as elsewhere, separation of some species and colonies of this genus from colonies of *Favites* (and sometimes even *Favia*) is often difficult, and this is evidenced in the identifications of many of the older QM specimens; two specimens of *Acanthastrea lordhowensis* collected by Hedley in 1924 were labeled '*Favia speciosa*'. These records also contradict the previous perception of no living records of *Acanthastrea* before the 1974 flood (in evidence available to Lovell 1989). Field identification of the genus is enhanced by observations of a fleshy polyp type.

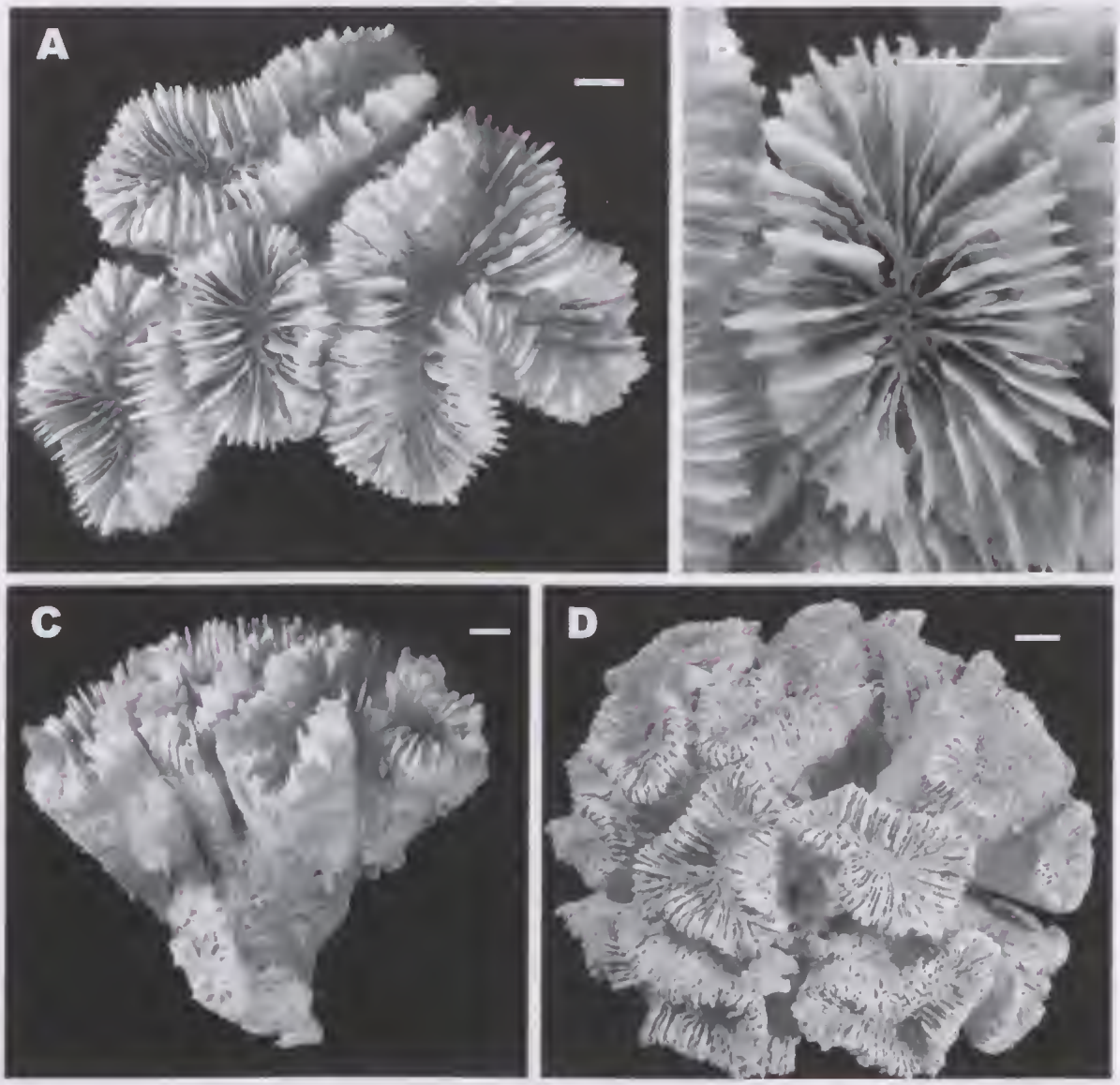

FIG. 53. *Lobophyllia corymbosa*: A, B, C, from Peel Island (MTQ-G56584); D, fossil from Mud Island (MTQ-G58553). A, C, portion of colony; D, whole colony; B, close-up of part of colony. Scale bars: 10 mm.

Acanthastrea echinata (Dana, 1846) (Figs 7A, 54)

Astræa echinata Dana, 1846: 229, pl. 12, figs 1, 1a–b. [Type locality: Fiji].

Acanthastrea spinosa Milne Edwards & Haime, 1846: 495.

Astræa patula Dana, 1846: 209, pl. 10, figs 14a–e.

Astræa dipsacea Lamarck, 1816: 262.

Astrea dipsacea Audouin, 1826:234, pl. 5, fig. 3.

Acanthastrea hirsuta Milne Edwards & Haime, 1850: 145.

Acanthastrea brevis Milne Edwards & Haime, 1850: 146.

Acanthastrea grandis Milne Edwards & Haime, 1850: 146.

Material Examined. *Living Moreton Bay*: MTQ-G57796, Peel I., PLH, 1994; MTQ-G56533, Peel I., IF, 2002; MTQ-G59228, G59431, Peel I., CCW, IF, PRM, 2003; MTQ-G55332, G59229, G59235–36, Peel I., CCW, IF, PRM, 2005; MTQ-G60166, Peel I., H. Fukami, 2007; MTQ-G60164, Myora, H. Fukami, 2007; MTQ-G56564, Green I., CCW, IF, PRM, 2003; MTQ-G59237, Green I., CCW, IF, PRM, 2005; MTQ-G59234, Green I. PLH, 1991; MTQ-G60165, Green I., H. Fukami, 2007; MTQ-G57819, G59233, Empire Point, PLH, 1991; MTQ-G59231, Wellington Point, IF, 2003; MTQ-G59230, G59238, Goat I., CCW, IF, PRM, 2005; MTQ-G60162- 63, Goat I., CCW, PRM, 2007. *Fossil Moreton Bay*: MTQ-G57794, Empire Point, CCW, IF, PRM, 2003; MTQ-G61531, Empire Point, CCW, IF, PRM, 2005. *Living outside Bay*: QM-G7284, Flinders Reef, E. Lovell, 1973; Flinders Reef, visual record CCW, 2005. *Further south*: recorded to Solitary Is, NSW (Harriott *et al.* 1994).

Skeletal Characteristics. Corallum massive or thick encrusting. Corallites round to angular; dividing by mono- or di-stomodeal budding; no budding in some specimens; greatest diameters 11–22 mm; depth 5–9.9 mm. Septa exsert, 32–48, S1≈S2>S3>S4 continous across top of corallite, 1–5 teeth on top; within corallite, 2–8 septal teeth; sides of septa granulated; up to three septal orders, first and second subequal, mostly to columella; second sometimes joins first; third up to 2/3R, but sometimes absent; no paliform lobes. Columella round swirl of twisted trabeculae or basal septal spines. No costae.

Field Characteristics. Colonies mostly less than 300 mm in diameter, with prominent septal spines; colour dark brown or reddish brown.

Distribution. Widespread Indo-Pacific from East Africa, Red Sea and Arabian Gulf to French Polynesia. East Australia: Great Barrier Reef south to Solitary Islands, northern NSW.

Remarks. This species name was previously applied more broadly and subsequently some of the older QM specimens have been re-allocated to other species.

Further Literature. Harriott *et al.* (1994); Banks & Harriott (1995); Veron *et al.* (1977); Veron (2000).

Acanthastrea hemprichii (Ehrenberg, 1834) (Figs 7B, 55)

Astrea hemprichii Ehrenberg, 1834: 320. [Type locality: Red Sea].

Material Examined. *Living Moreton Bay*: MTQ-G55333, Peel I., CCW, IF, PRM, 2005; MTQ-G60154, G60156, Peel I., H. Fukami, 2007; MTQ-G55334–36, Goat I., CCW, IF, PRM, 2005; MTQ-G60152, Goat I., CCW, PRM, 2007; MTQ-G60153, G60155, Myora, H. Fukami, 2007. *Living outside Bay*: QM-G7284, Flinders Reef, E. Lovell, 1973; visual record IF, 2005.

Skeletal Characteristics. Corallum domed, thick encrusting or massive but eroded underneath. Corallites round to angular, larger on top than on sides; dividing by mono-, di- and tri-stomodeal budding; greatest diameters 9–18 mm; depths 5–11.5 mm. Septal count 26 –51; first cycle reaching columella, S1≈S2≈S3>S4; septa exsert, continuous over top of corallite, 2–4 teeth on tops; inside corallite, 6–9 teeth on septa, paliform lobes absent. Columella a round to oval tangle of trabeculae or basal septal spines. Costae absent.

Field Characteristics. Domed plocoid colonies, up to about 500 mm diameter, with fleshy corallites. Colour usually grey or greyish-brown, with or without bright green centres.

Distribution. Western Indian Ocean and Red Sea, as well as a central Indo-Pacific (Veron 2000). East Australia: Great Barrier Reef south to Moreton Bay region.

Remarks. The type specimen was not found at the Humboldt Museum and its identity could not thus be verified as part of the present study. We here follow Veron's (2000) interpretation of this species. Veron (2000) regards this species as being predominantly sub-tropical.

Acanthastrea bowerbanki Haime & Milne Edwards, 1857 (Figs 7C, 56)

Acanthastrea bowerbanki Haime & Milne Edwards, 1857: 503–504. [Type locality: 'Habite l'Australie'].
Acanthastrea angulosa Brüggemann, 1879: 573.

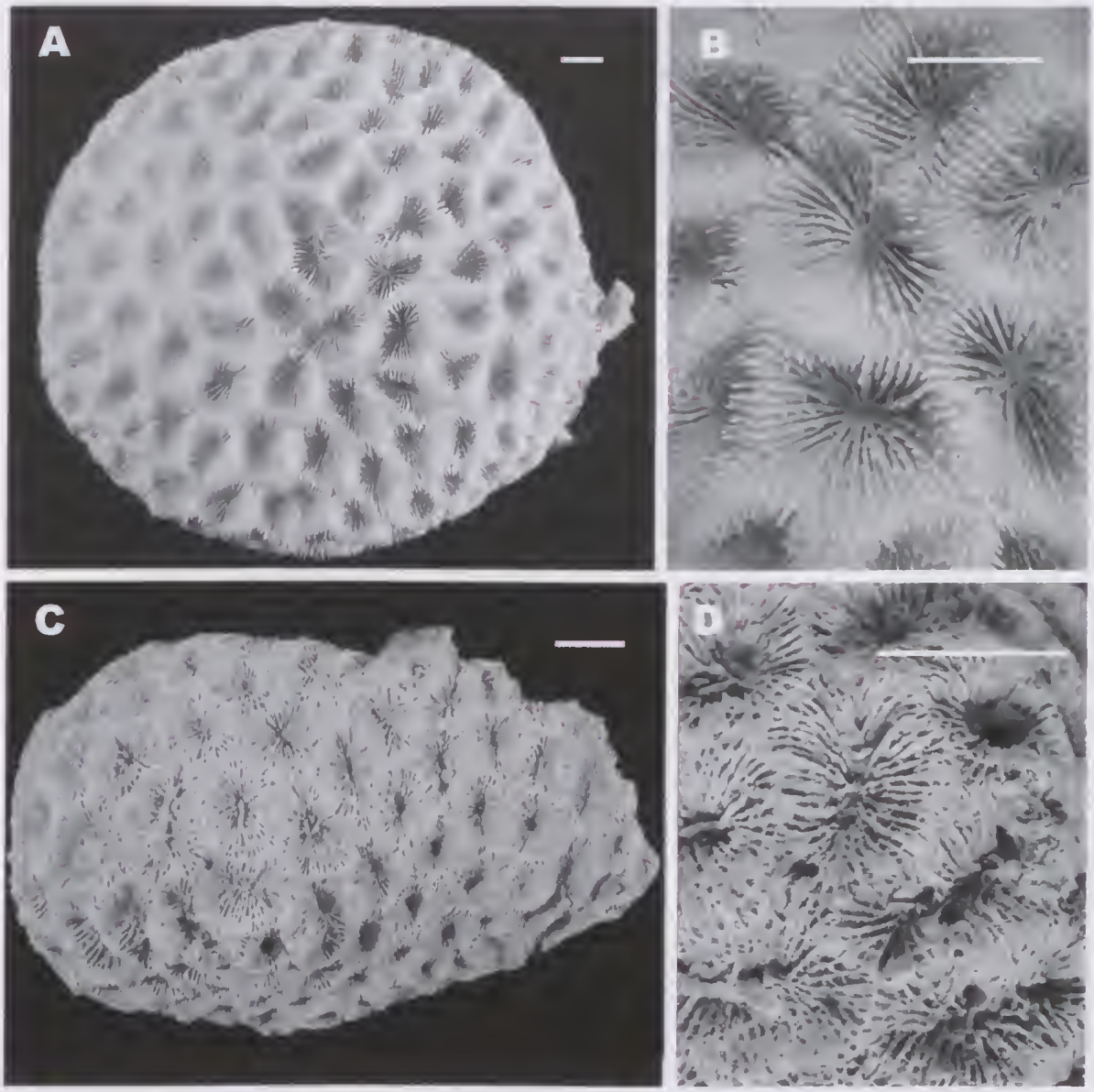

FIG. 54. *Acanthastrea echinata*: A, B, from Wellington Point (MTQ-G59231); C, D, fossil from Empire Point (MTQ-G57794). A, C, whole colony; B, D, close-up of part of colony. Scale bars: 10 mm.

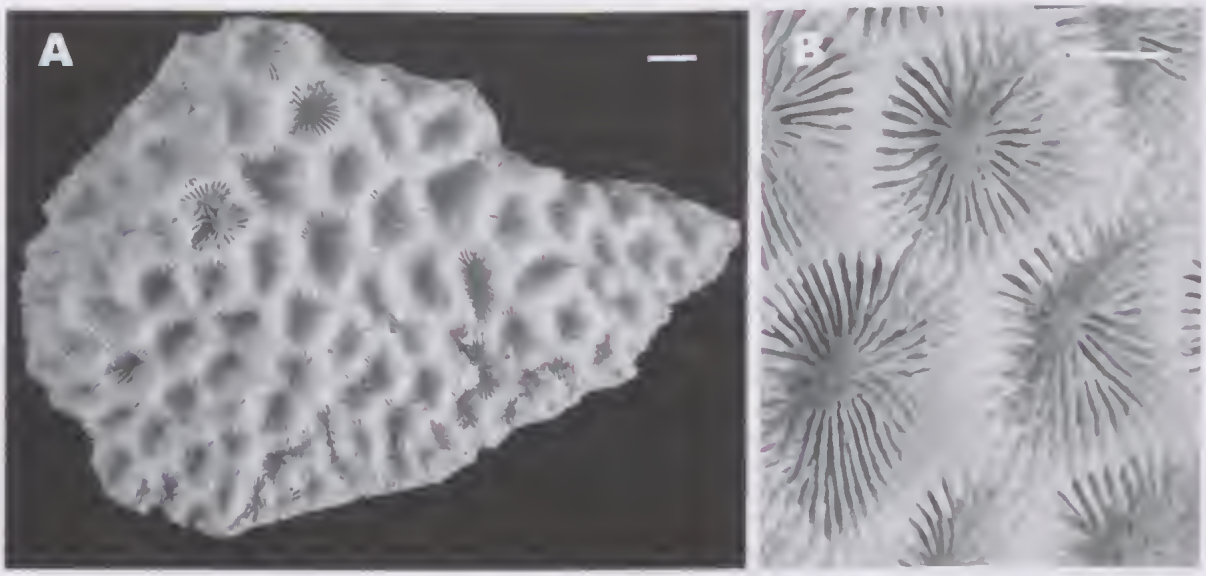

FIG. 55. *Acanthastrea hemprichii* from Goat Island (MTQ-G55336). Scale bars: A = 10 mm; B = 5 mm.

Material Examined. *Living Moreton Bay*: MTQ-G56536, Peel I., IF, 2002; MTQ-G55337, Peel I., CCW, IF, PRM, 2005; MTQ-G61502–503, Peel I., H. Fukami, 2007; MTQ-G61506, Peel I., CCW, PRM, 2007; MTQ-G55338, Green I., CCW, IF, PRM, 2005; MTQ-G61504, Green I., H. Fukami, 2007; MTQ-G55343, Goat I., CCW, IF, PRM, 2005; MTQ-G61505, Goat I., CCW, PRM, 2007; MTQ-G55342, Myora, CCW, IF, PRM, 2005; MTQ-G69375, Empire Point, CCW, IF, PRM, 2005. *Fossil Moreton Bay*: MTQ-G61545, Mud I., IF, 2004. *Living outside Bay*: QM-G7284 Flinders Reef, E. Lovell, 1973; Flinders Reef, visual record CCW, 2005.

Skeletal Characteristics. Corallum domed, thick encrusting or massive but eroded underneath. Corallites larger on top than on sides; angular, dividing by mono-, di- and tristomodeal budding; greatest diameters 13 – 36 mm; depths 4.5 – 14.5 mm. Septal count 34 – 76; first septal cycle reaching the columella, S1≈S2>S3>S4 ; septa slightly exsert, up to 7 long teeth on top, inside corallite the number of teeth variable but up to 14; teeth long and pointed; paliform lobes absent. Columella a round to oval dense tangle of basal septal spines. Costae absent.

Field Characteristics. Domed plocoid colonies, up to around 500 mm diameter, with fleshy corallites. Colour usually grey or greyish-brown, with or without bright green centres.

Distribution. Western Pacific, central Indo-Pacific, and western Pacific, with high latitudinal distribution in the north and south. East Australia: Great Barrier Reef south to Lord Howe Island, NSW (Harriott *et al.* 1995).

Remarks. Veron (2000) regards this species as being predominantly sub-tropical.

Further Literature. Veron & Pichon (1980); Harriott *et al.* (1995); Veron (2000).

Acanthastrea hillae Wells, 1955
(Figs 7E, 57)

Acanthastrea hillae Wells, 1955: 15, pl. 2, figs 2, 3. [Type locality: Moreton Bay (subfossil)].

Material Examined. HOLOTYPE: QM-F17943, subfossil, Mud I. *Living Moreton Bay*: MTQ-G58486, Goat I., CCW, IF, PRM, 2005. *Fossil Moreton Bay*: Holotype as above. *Living outside Bay*: MTQ-G58484, Flat Rock, CCW, IF, PRM, 2005; MTQ-G60158, Shag Rock, H. Fukami, 2007; QM-G6997, Flinders Reef, E. Lovell, 1972; Flinders Reef, visual record CCW, IF, 2005. *Further south*: recorded to Lord Howe I. (Harriott *et al.* 1995).

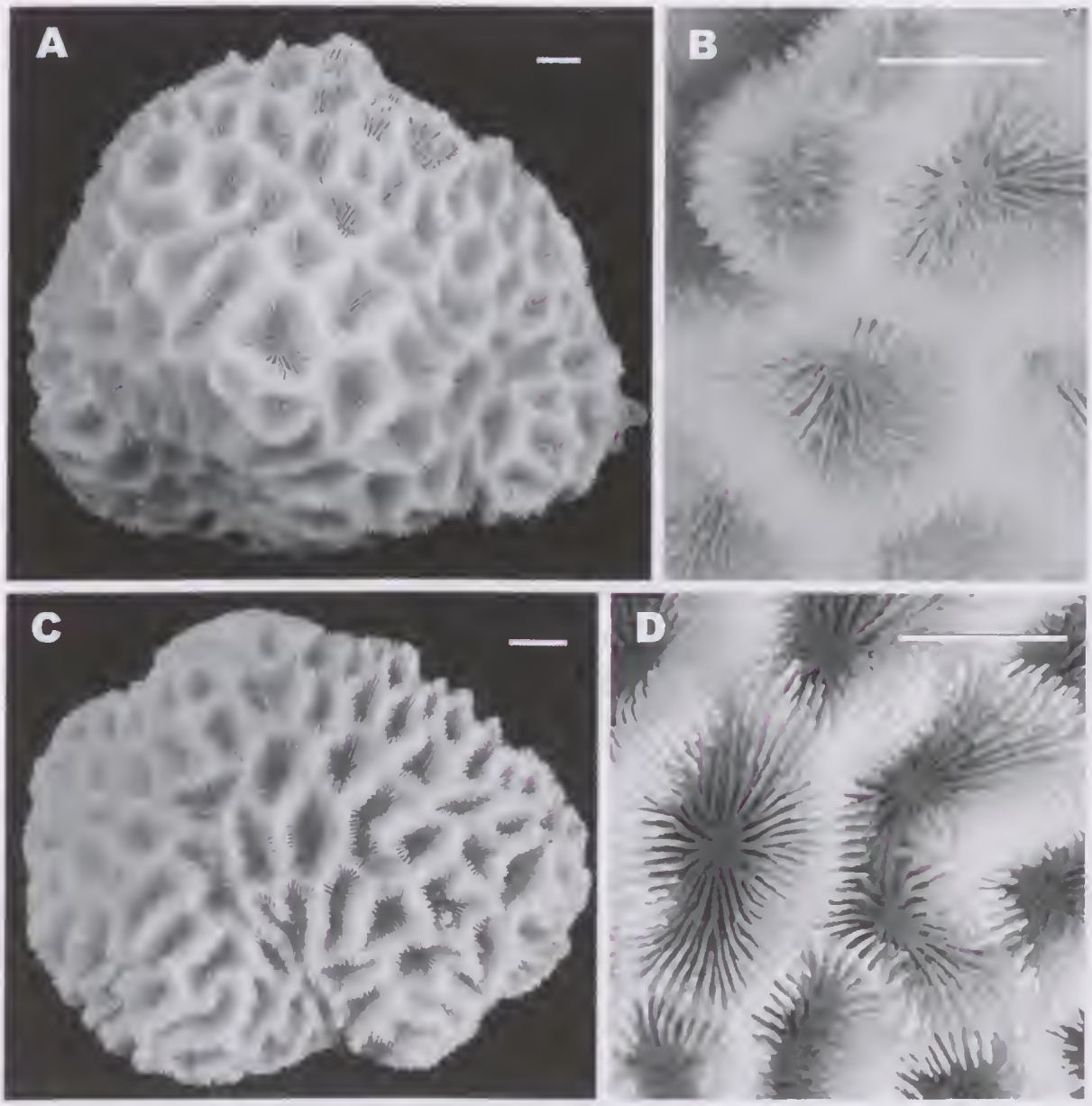

FIG. 56. *Acanthastrea bowerbanki*: A, B, from Peel Island (MTQ-G56536); C, D, from Goat Island (MTQ-G55343). A, C, whole colony; B, D, close-up of part of colony. Scale bars: A, C = 10 mm; B, D = 5 mm.

Skeletal Characteristics. Corallum submassive, initial growth from a large central corallite but budding includes some intratentacular budding to form valleys with up to four centres; monocentric corallites up to 45 mm in longest diameter. Septa thick, up to 60 in number, about half reaching columella, S1≈S2≈S3≈S4; septa equally exsert above theca, more or less adjoined across walls. Columella compact, sunken into a pit below ends of septa.

Field Characteristics. This species has larger and coarser corallites than all other *Acanthastrea* species in the bay.

Distribution. Western Pacific, central Indo-Pacific, and western Pacific, with high latitudinal distribution in the north and south. East Australia: Great Barrier Reef south to Lord Howe Island, NSW (Harriott *et al.* 1995).

Remarks. Although described from subfossils, this is an extant species and broadly reported, e.g. from Western Australia (Veron & Marsh 1988), and occasionally on the Great Barrier Reef (Veron & Pichon 1980). The Moreton Bay collections and surveys indicate, however, that it is no longer a common species in the bay, and may only be present as occasional recruits from reefs outside South Passage. The coarse septal structures and large corallite dimensions of the type, and specimens from the Moreton Bay region, suggest that the identity of this species may have been misinterpreted in the past.

Further Literature. Banks & Harriott (1995); Harriott *et al.* (1995); Veron (2000).

Acanthastrea lordhowensis Veron & Pichon, 1982 (Figs 7D, 58)

Acanthastrea lordhowensis Veron & Pichon, 1982: 138. [Type locality: Lord Howe Island].

Material Examined. HOLOTYPE: MTQ-G57483, North Bay, Lord Howe I. *Living Moreton Bay*: MTQ-G56540, G56590–91, Peel I., IF, 2001; MTQ-G57818, Peel I., PLH, 1991; MTQ-G59216, Peel I., IF, 2002; MTQ-G60191, Peel I., H. Fukami, 2007; MTQ-G60190, Myora, H. Fukami, 2007; MTQ-G59215, Green I., PLH, 1991; MTQ-G60189, Goat I., CCW, PRM, 2007; MTQ-G59217, Moreton Bay, CCW, IF, PRM, 2005; QM-G7031, Peel I., E. Lovell, 1971; QM-G6628, Peel I., M. Dredge, 1971; QM-G6626, G6628, Green I., M. Dredge, 1971; QM-GBRC 627, Peel I., C. Hedley, 1924; QM-G7311, Peel I., E. Lovell, 1972. *Fossil Moreton Bay*: MTQ-G56587, Mud I., CCW, IF, PRM, 2003; MTQ-G56588–89, Empire Point, CCW, IF, PRM, 2003. *Living outside Bay*: MTQ-G59227, Shag Rock, IF, 2005; Flinders Reef, recorded Veron (1993). *Further south*: recorded to South West Rocks, NSW (Harriott *et al.*1999).

Skeletal Characteristics. Corallum submassive or thick encrusting, cerioid, sometimes with columnar protuberances formed by budding and overcrowding of corallites in isolated areas of the colony; budding both extra- and intra-tentacular; corallites polygonal, often strongly compressed in a long plane, generally more compacted on the sides of colonies and more polygonal on growing margins. Some areas of corallum may have sub-plocoid growth. Corallites with mono-, di- or tri-stomodeal budding (only monostomodeal in some specimens); elongate, greatest diameters 8–23 mm; depth 4–12.5 mm. Septa 32–54; S1≈S2>S3>S4; septa slightly exsert, continuous across top of corallite; 2–5 large teeth at top of septum, within corallite 3–7 medium to large teeth; sides of septa granulated. Columella a tangle of tightly interwoven trabeculae at base of septa; no paliform lobes. Coenosteum barely visible because of crowded corallites.

Field Characteristics. Colonies have distinctive bright colouration including vermillion, green, grey, and distinctive white striping around edge of polyp.

Distribution. Indo-Pacific: East Africa through to Samoa, with high latitude occurrences in the north and south western Pacific. East Australia: Great Barrier Reef south to Lord Howe Island, NSW (Harriott *et al.* 1995).

Remarks. Previously unrecorded, but abundant in the bay. Specimens collected by Hedley for the Great Barrier Reef Committee in 1924, as well as fossils, indicate the long-term presence of this colourful and distinctive species. Although

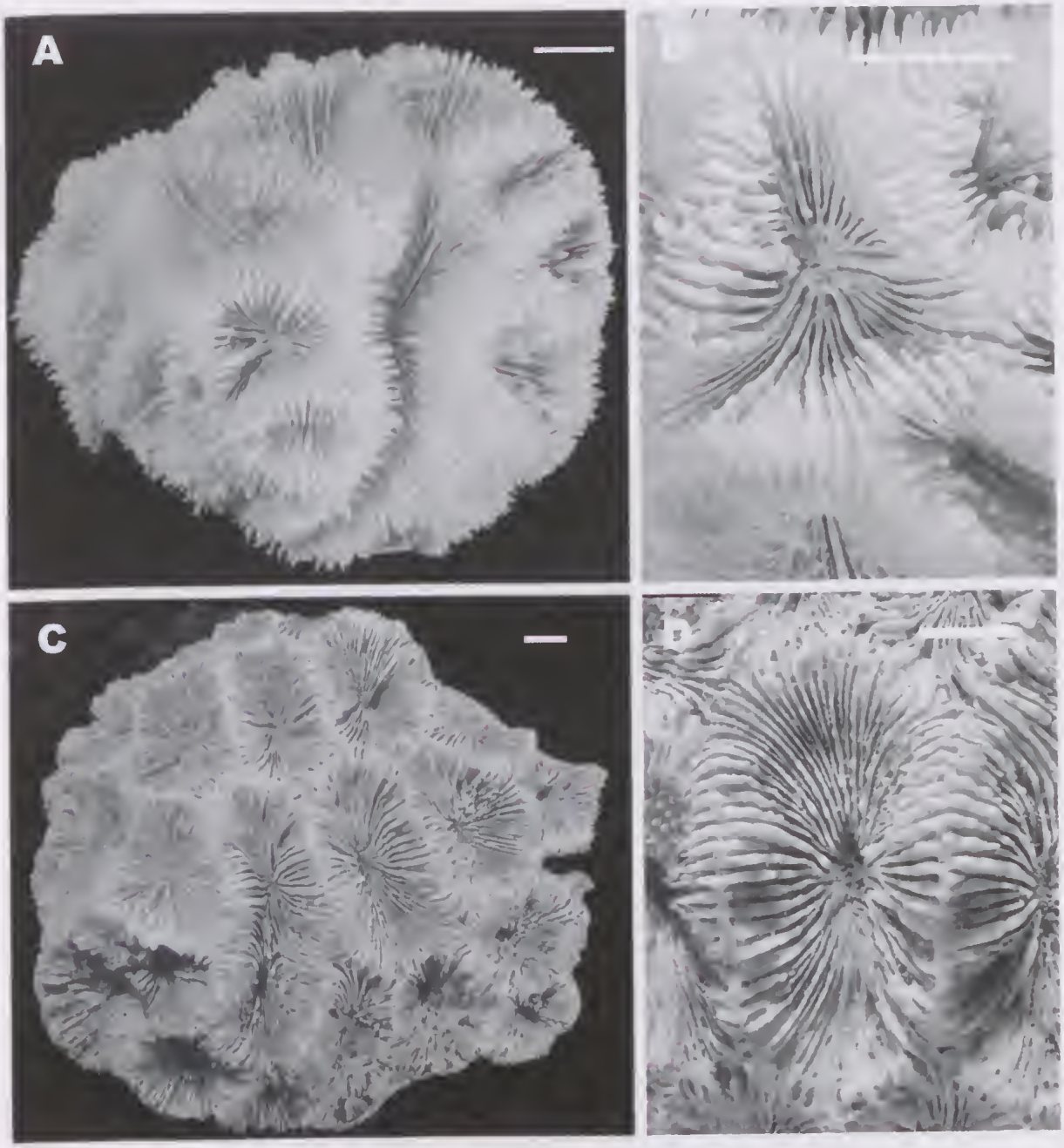

FIG. 57. *Acanthastrea hillae*: A, B, from Goat Island (MTQ-G58486); C, D, holotype fossil from Moreton Bay (QM-F17943). A, C, whole colony. B, D, close-up of part of colony. Scale bars: 10 mm.

described from Lord Howe Island and Hong Kong as recently as 1982, this species is now known to have a broad high latitude Indo-Pacific distribution. It is the easiest species of *Acanthastrea* to recognise in Moreton Bay, because of the distinctive speckled colouration of the polyp edges, and strongly angular corallites.

Further Literature. Banks & Harriott (1995); Harriott *et al.* (1995); Wilson & Harrison (1997, 2003); Veron (2000).

Micromussa Veron, 2000

Type species. *Acanthastrea amakusensis* Veron, 1990.

Diagnosis. Colonies submassive or encrusting, usually flat. Corallites cerioid or subplocoid, circular or angular in shape and up to 8 mm diameter. Septa thickened at corallite wall, with conspicuous teeth. Colonies may have fleshy tissue over the skeleton, but skeletal structures remain visible. Tentacles extended only at night. No fossil record. (After Veron 2003).

Micromussa amakusensis (Veron, 1990) (Figs 7F, 59)

Acanthastrea amakusensis Veron, 1990: 137, figs 42–44, 82. [Type locality: Japan].

Material Examined. HOLOTYPE: MTQ-G32485, Amakusa I., Japan. *Living Moreton Bay*: MTQ-G59224, Peel I., CCW, IF, PRM, 2005; MTQ-G59225, Green I., CCW, IF, PRM, 2005; MTQ-G59226, Goat I., CCW, IF, PRM, 2005; MTQ-G58070, Wellington Point, PLH, 1991; *Fossil Moreton Bay*: QM-UQ Collection temporary nos. 017, 021, 022, Moreton Bay. *Living outside Bay*: MTQ-G59227, Shag Rock IF, 2005.

Skeletal Characteristics. Corallum encrusting to massive, flat-topped. Corallites round to angular, dividing by mono-, di- and tri-stomodeal budding. Corallite diameter 6–12.5 mm; depth 1.5–4.5 mm. Septa 30–45, S1≈S2≈S3>S4; first and second cycles thicker and reaching columella; barely exsert, sometimes, but not always continuous across top, sometimes a line between corallites; septa with 1–3 thickened teeth at top; up to 5 swollen teeth inside corallite, teeth and sides of septa granulated; no paliform lobes but larger teeth at bottom. Columella small to large, dense round tangle of trabeculae.

Field Characteristics. Colonies low hemispherical, with small, fleshy polyps. Colour grey with brick-red oral discs.

Distribution. Central Indo-Pacific and Western Pacific plus Gulf of Aden (from Veron 2000) East Australia: Central Great Barrier Reef to Moreton Bay region.

Remarks. Several differences occur between the Moreton Bay specimens and the type from Japan. In particular, a larger number of septa, and the presence of second and third septal orders, suggest that the Moreton Bay specimens could represent a new species.

Further Literature. Veron (1990).

Blastomussa Wells, 1961

Type species. *Blastomussa merleti* Wells, 1961.

Diagnosis. Colonial, colony formation by extratentacular budding from the edge-zone, producing small phaceloid to cerioid tufts of erect cylindrical corallites. Corallite walls septothecal, costate, with narrow edge zone and delicate epitheca. Septa stout. *Pleistocene to Recent.*

Blastomussa wellsi Wijsman-Best, 1973 (Fig. 60)

Blastomussa wellsi Wijsman-Best, 1973: 154–155. [Type locality: New Caledonia].

Material Examined. Living Moreton Bay: MTQ-G59433, Peel I., PLH, 1991. Fossil Moreton Bay: MTQ-G59551, Empire Point, CCW, IF, PRM, 2005. Further south: MTQ-G42934, Newcastle, AIMS, 1978–1984; MTQ-G42947, Evans Head, AIMS, 1978–1984.

Skeletal characteristics. Corallum small, flat-topped massive. Corallites round, dividing by mono-stomadeal extratentacular budding; greatest diameters 8.5–14 mm; depths 2.5–3.5 mm; septal count 24–38; first cycle reaching columella, S1>S2≈S3>S4; S3 often joining S2 to form a triplet. Septa with up to 6 large teeth; sides of teeth are minutely ornamented by triangular granulations

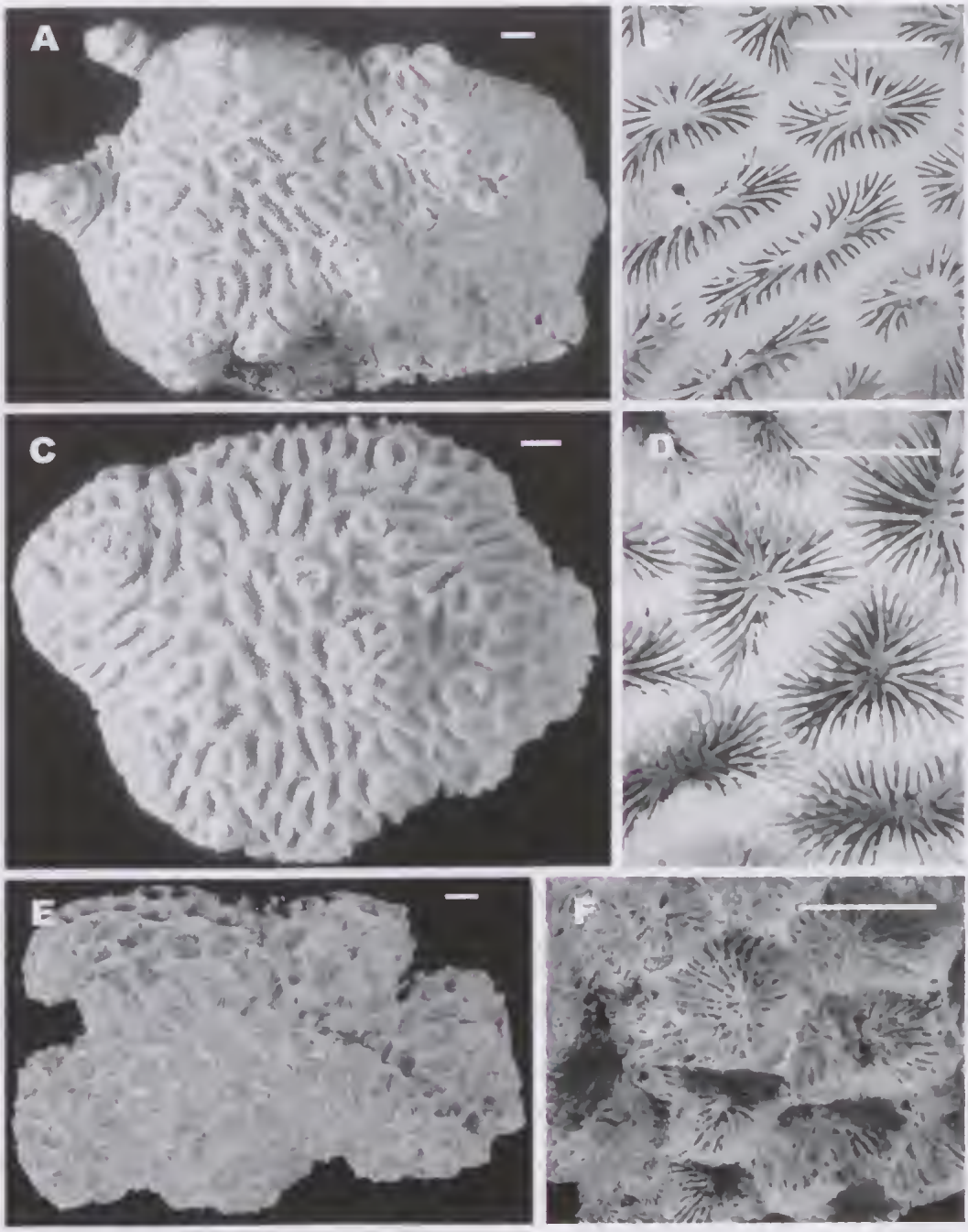

FIG. 58. *Acanthastrea lordhowensis*: A, B, from Peel Island (MTQ-G56540); C, D, from Peel Island (QM-G6628); E, F, fossil from Empire Point (MTQ-G56589). A, C, E, whole colony. B, D, F, close-up of part of colony. Scale bars: 10 mm.

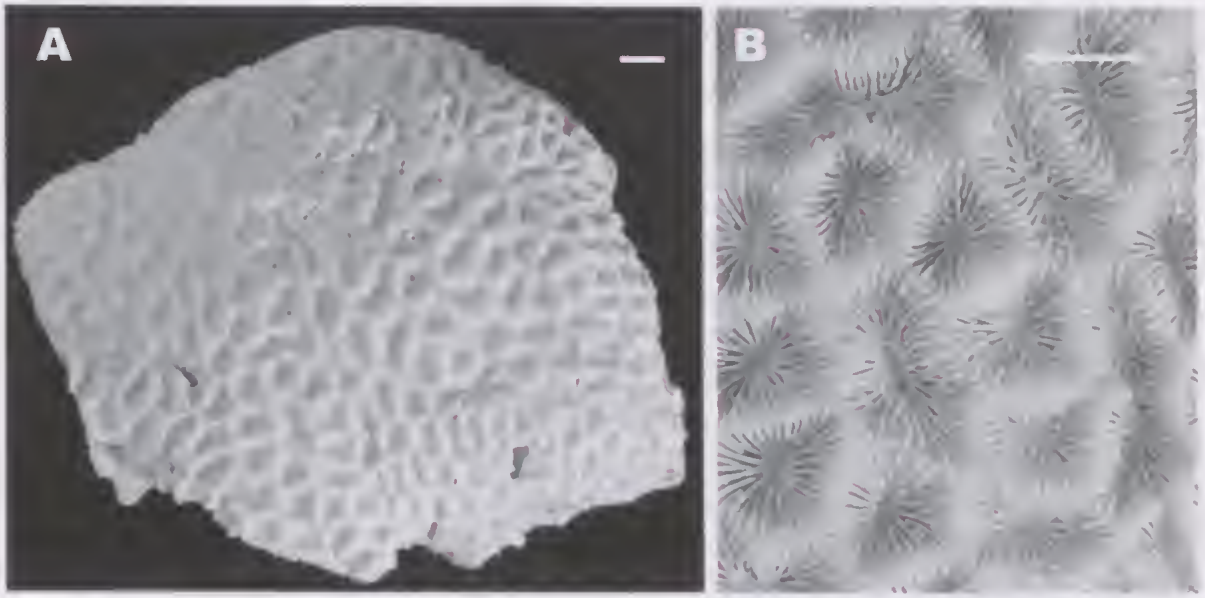

FIG. 59. *Micromussa amakusensis* from Green Island (MTQ-G59225). A, portion of colony; B, close-up of part of colony. Scale bars: 10 mm.

with sharp points. Columella just recognisable as a tangle of a few septal teeth.

Field Characteristics. Colonies low massive, pale brown. An additional living colony was observed but not collected at Peel Island, by PH in 1991, and another by CW, IF and PM in September 2003.

Distribution. Central Indo-Pacific and western Pacific. East Australia: Great Barrier Reef south to Newcastle region.

Remarks. The description above covers the specimens from Moreton Bay and further south. Specimens at MTQ from sites in northern Queensland are more cerioid and their corallites have a more polygonal outline: some also have a more developed columella with a central ridge. This species is also observed in Pleistocene assemblage at Evans Head, northern NSW (Pickett 1981).

Further Literature. Pickett (1981), Harrison et al. (1991); Harrison & Veron (1993).

PECTINIIDAE Vaughan & Wells, 1943

Diagnosis. Solitary and colonial hermatypic corals with colony formation by intratentacular polystomodeal budding; polyps and corallites organically united throughout; linkages by interstomodeal mesenteries and thin lamellae. Corallum fixed, explanate to foliaceous, rarely submassive, with light structures. Corallites lacking definite walls; coenosteum abundant to practically absent. Septa irregularly dentate, formed by one fan system of compound trabeculae which may produce spinose dentations of mussid or merulinid type, or dentations may be almost completely reduced. Columella trabecular, feeble or absent. *Oligocene to Recent.*

Echinophyllia Klunzinger, 1879

Type species. *Echinophyllia aspera* (Ellis & Solander, 1786).

Diagnosis. Colonial, colony formation in earlier stages by circumoral budding, followed by irregular polystomodeal budding, forming spreading explanate corolla. Calices parallel to

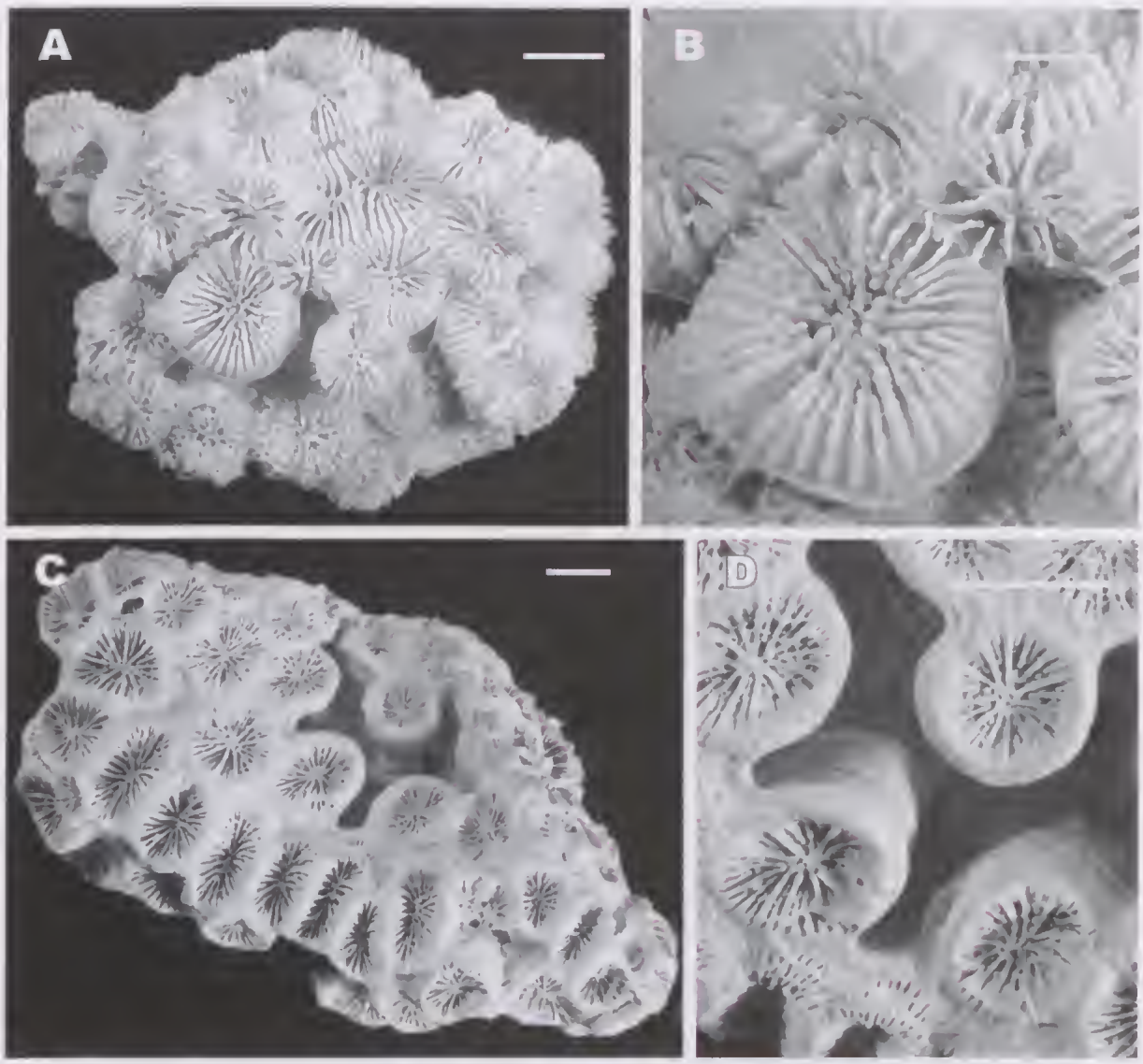

FIG. 60. *Blastomussa wellsi*: A, B, from Peel Island (MTQ-G53433); C, D, fossil from Empire Point (MTQ-G59551). A, C, whole colony; B, D, close-up of part of colony. Scale bars: A, C, D = 10 mm; B = 5 mm.

plane of frond, united by vesicular coenosteum and confluent septocostae. *Miocene to Recent.*

Echinophyllia aspera (Ellis & Solander, 1786) (Figs 8F, 61)

Madrepora aspera Ellis & Solander, 1786: 156, pl. 39. [Type locality: 'Eastern Indian Ocean'].

Material Examined. *Living Moreton Bay*: MTQ-G56537, Peel I., IF, 2002; MTQ-G56572 –73, G56576, Peel I., CCW, IF, PRM, 2003; MTQ-G57834, Peel I., PLH, 1994. *Fossil Moreton Bay*: MTQ-G56574–75, Mud I., CCW, IF, PRM, 2003; MTQ-G58460, Empire Point, CCW, IF, PRM, 2005. QM-UQ Collection temporary no. 004–007, Moreton Bay. *Living outside Bay*: Flinders

Reef, recorded Veron (1993). *Further south*: recorded to Solitary Is (Harriott *et al.* 1999).

Skeletal Characteristics. Corallum submassive centrally and surrounded by encrusting, then laminar, regions. Corallites tall tubular (up to 20 mm length on raised parts of colony) to immersed; greatest diameter up to 15 mm; corallites on laminar regions and particularly around edge zone inclined outwards. Septa mostly similar in size and most reach the columella; exsert up to 5 mm, number variable; upper part of septum enlarged as a lobe and large teeth developed below this. Costae with multiple-spiked teeth extend to form coenosteum.

Field Characteristics. Colonies to about 1 m in diameter with very irregular surface, including submassive areas surrounded by encrusting and then folacious surfaces. Colour brown or brownish green. The large corallites and extremely spiky surface make this a very distinctive species in the bay, although its colour is somewhat cryptic.

Distribution. Widespread Indo-Pacific from East Africa, Red Sea and Arabian Gulf to central Pacific. East Australia: Great Barrier Reef south to Solitary Islands, NSW and Lord Howe Island (Harriott *et al.* 1995).

Remarks. This species was possibly misidentified as *Mycedium elephantotus* by Lovell (1991) from his 1972–73 surveys of Green and Peel Islands, and may also be the '*Euphyllia*' reported from Peel Island by Slack-Smith (1960). Other than those records it was not reported live from Moreton Bay until the 1994 specimen above. Although not abundant, it now appears well established, with large mature colonies occurring at Peel Island and Myora. It is very common in the fossil banks, and its absence from collections, and from earlier reports of living corals, until 1994 could indicate a cyclical presence in the bay.

Further Literature. Wells (1954); Veron & Pichon (1980) and contained references; Harrison *et al.* (1995); Harriott *et al.* (1995); Veron (2000).

TURBINOLIIDAE

Diagnosis. Ahermatypic, solitary, free, trochoid, cuneiform, or conical, completely invested by polyp; intercostal grooves are deeply incised from calicular margin to points of origin of costae.

Conocyathus d'Orbigny, 1849

Type species. *Conocyathus sulcatus* d'Orbigny, 1849.

Diagnosis. Trochoid, not compressed; wall regularly perforated between costae; columella spongy; pali forming one crown after opposite second cycle. *Oligocene to Recent.*

Conocyathus zelaudiae Duncan, 1876 (Fig. 62)

Conocyathus zelandiae Duncan, 1876: 43, pl. 38, figs 1–3. [Type locality: New Zealand].

Turbinolia australiensis Gardiner, 1939: 332, pl. 21, figs 1–2.

Material Examined. *Living Moreton Bay*: MTQ-G55330, Moreton Bay, one wet specimen, J. Taylor and E. Glover, 2005; QM-G7172, dredged, southern end of Pearl Channel, 1962. *Further south*: recorded from New South Wales and Victoria (Cairns 2004)

Skeletal Characteristics. Solitary, single polyp, symmetrical, cone-shaped with round corallite and tapering to a point. Septa in three cycles; S1>S2>S3; septa exsert, first cycle septa thickened at the top, alternating with a tripod consisting of two S3 septa joining a central S2 septum at about its central point, giving six triplets and six individual septa; base of tripod thickened. Columella a single boss. Costae 48, of which only 24 correspond to septa, the first and second cycles reach the bottom of the cone and form a star shape.

Field Characteristics. Solitary in sandy mud. Colour pale pinkish-brown.

Distribution. Australia and New Zealand. East Australia: southern Great Barrier Reef to Sydney (Wells 1964; Cairns 2004).

Remarks. There is some doubt concerning the type locality of this species (see Cairns 1995).

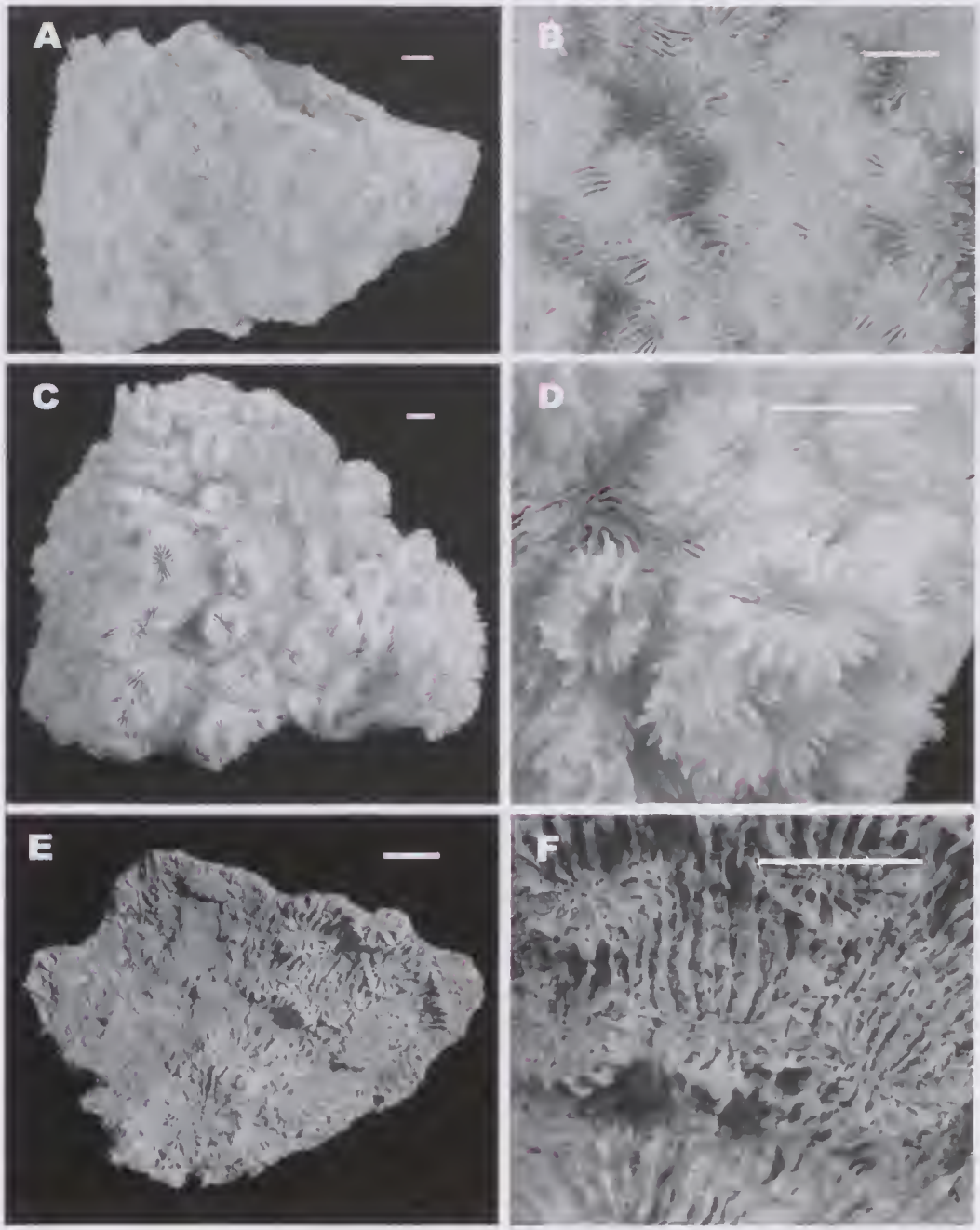

FIG. 61. *Echinophyllia aspera*: A, B, from Peel Island (MTQ-G56572); C, D, from Peel Island (MTQ-G56576); E, F, fossil from Mud Island (MTQ-G56574). A, C, E, portion of colony; B, D, F, close-up of part of colony. Scale bars: 10 mm.

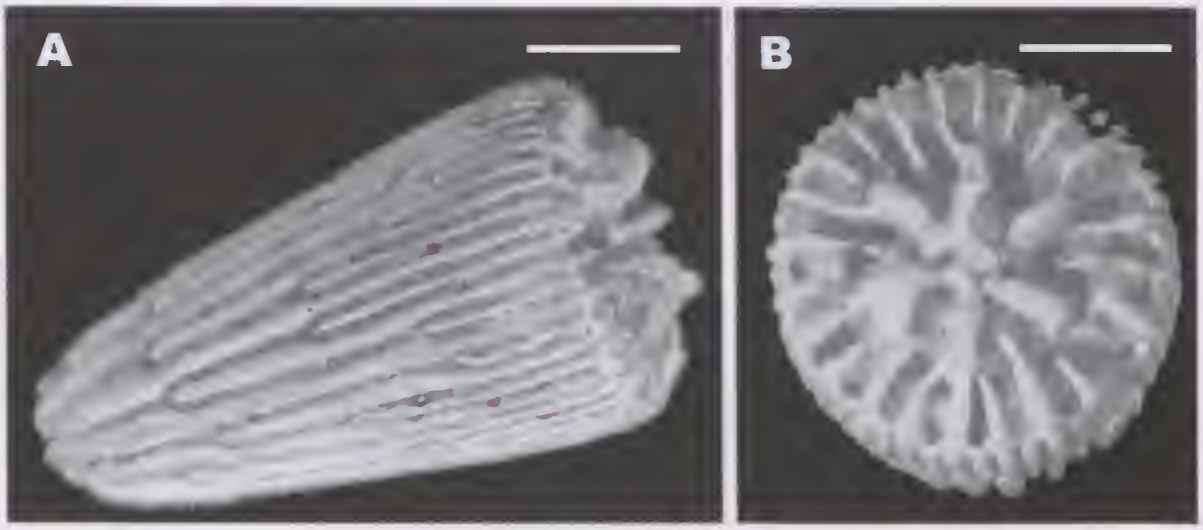

FIG. 62. *Conocyathus zelandiae* from southern end of Pearl Channel, Moreton Bay (QM-G7172). Scale bars: 1 mm.

Further Literature. Stephenson & Wells (1956); Wells (1955); Cairns (2004) (includes an *Eocene* synonym).

Suborder DENDROPHYLLIINA Vaughan & Wells, 1943

Diagnosis. Solitary and colonial corals. Wall synapticulothecal, irregularly porous. Septa primarily laminar as in Caryophilliina but generally secondarily thickened, more or less porous, with smooth or slightly dentate margins. *Upper Cretaceous to Recent.*

DENDROPHYLLIIDAE Gray, 1847

Diagnosis. Mostly ahermatypic, solitary and colonial; colony formation by intra- and extratentacular budding; wall formed by trabecular outer ends of septa and simple irregular synapticulae, usually thick, irregularly costate or covered by reduced costal granulations. Septa composed of one-fan system of simple trabeculae, strongly granulated laterally, mostly smooth marginally or wholly weakly dentate. Columella trabecular and spongy, or absent. Endothecal dissepiments thin and poorly-developed. Coenosteum porous and may be layered.

Turbinaria Milne Edwards & Haime, 1848

Type species. *Madrepora crater* Pallas, 1766.

Diagnosis. Hermatypic; large explanate or crateriform, contorted foliaceous colonies; corallites united nearly to summits by extensive coenosteum; columella well-developed. *Oligocene to Recent.*

Remarks. This genus is reported as a dominant taxon in most subtropical locations in eastern Australia (Harriott *et al.* 1994).

Turbinaria frondens (Dana, 1846) (Figs 8A, 63)

Gemmipora frondens Dana, 1846: 412, pl. 27, figs 10, 10a–c. [Type locality: Fiji].
Turbinaria edwardsi Bernard, 1896: 29, pls 3, 31, fig. 4.
Turbinaria aurantiaca Bernard, 1896: 33, pls 4, 31, fig. 9.
Turbinaria pustulosa Bernard, 1896:35, pls 3, 31, fig. 11.
Turbinaria abnormalis Bernard, 1896: 36, pls 6, 31, fig. 14.
Turbinaria magna Bernard, 1896: 48, pls 14–15, 32, fig. 3.
Turbinaria foliosa Bernard, 1896: 61, pls 18, 32, fig. 15.

Material Examined. *Living Moreton Bay*: MTQ-G57833, Peel I., PLH, 1994; MTQ-G56552, Peel I., IF, 2001; MTQ-G58442, Goat I., PLH, 2005; MTQ-G58436, Amity Rock Wall, CCW, IF, PRM, 2005; MTQ-G58437, Amity Rock Wall, PRM, 2005; QM-G5885, Green I., M. Dredge, 1971. *Fossil Moreton Bay*: MTQ-G56609, Empire Point,

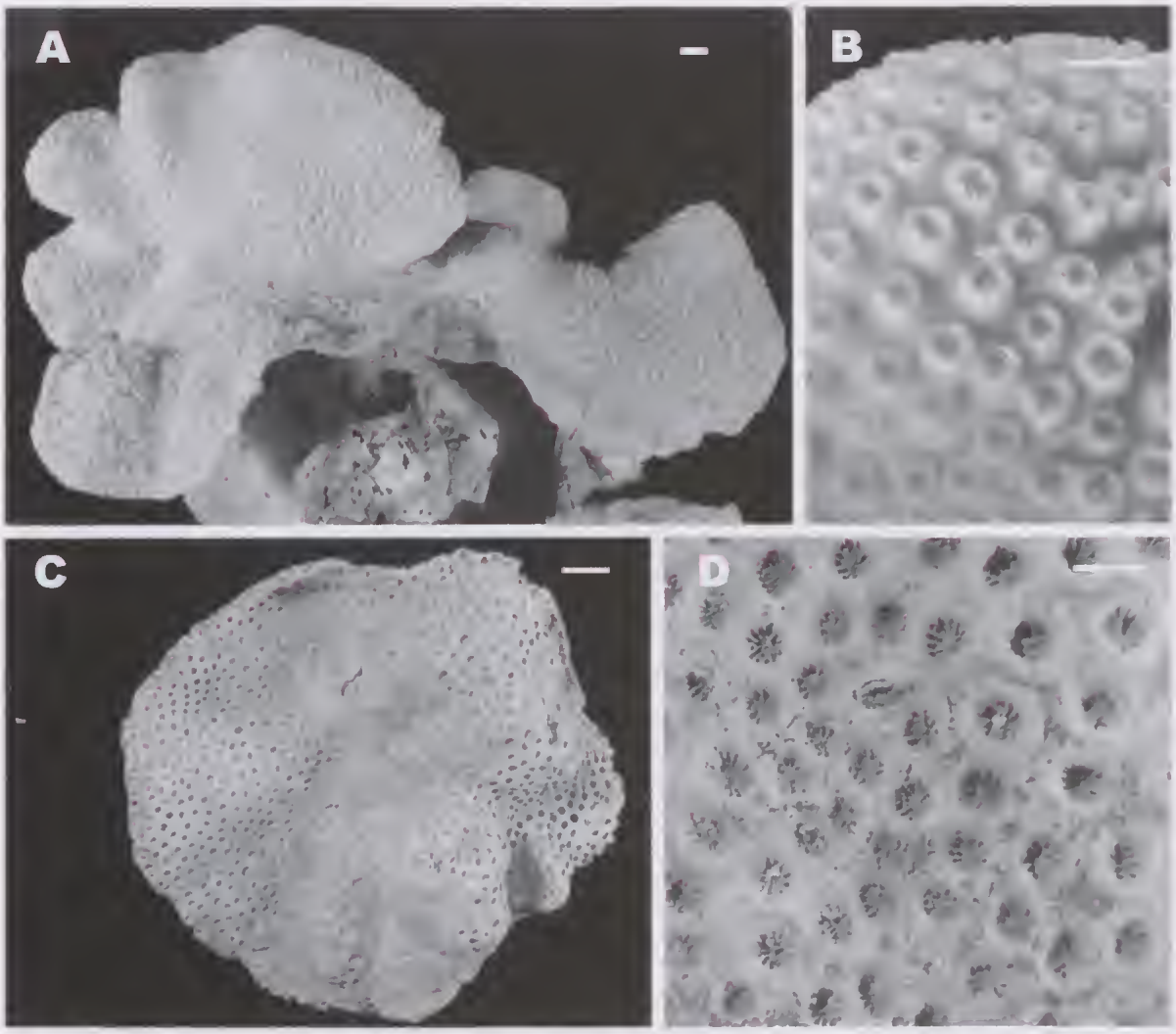

FIG. 63. *Turbinaria frondens*: A, B, from Green Island (QM-G5855); C, D, fossil from Empire Point (MTQ-G56609). A, C, whole colony; B, D, F, close-up of part of colony. Scale bars: A, C = 10 mm; B = 5 mm; D = 1 mm.

CCW, IF, PRM, 2003; MTQ-G58801, Mud I., CCW, IF, PRM, 2005; recorded as subfossil from Goat and Mud Is by Wells (1955) . *Living outside Bay*: QM-G7266, Flinders Reef, E. Lovell, 1973; Flinders Reef, visual record CCW, IF, 2005. *Further south*: literature records around southern Australian coast.

Skeletal Characteristics. From a central to side-attached stalk, a horizontal to convoluted plate or series of plates (foliaceous); juvenile colonies stalked with concave circular to oval upper surface ('crateriform'). Corallites immersed to conical with circular calices up to 3 mm in diameter. Septa of one order, 16–33, extending vertically into the corallite. Columella round to oval, slightly domed and sometimes with a weak central ridge. Coenosteum reticulate with flaky spinules.

Field Characteristics. Colonies as described above. Colour brown or grey; polyps sometimes extended during the day and pale grey in colour.

Distribution. Indo-Pacific from East Africa, Red Sea and Arabian Gulf to central Pacific. East Australia: Great Barrier Reef south to South West Rocks, northern NSW, and Lord Howe Island (Veron 1993) and around the entire coast of Australia (Veron 2000).

Remarks. The ability of this species to maintain a steady growth rate throughout the winter months even at a latitude of 30°S indicates its suitability for high latitude sites (Harriott 1999).

Further Literature. Lovell (1989); Harriott *et al.* (1994, 1995); Banks & Harriott (1995); Harriott (1999); Veron (2000).

Turbinaria peltata (Esper, 1794) (Figs 8B, 64)

Madrepora peltata Esper, 1794: 27, fig. 13. [Type locality: unknown].
Turbinaria dichotoma Verrill, 1871: 89.
Turbinaria maxima Ortmann, 1888: 160, pl. 6, fig. 4.

Material Examined. *Living Moreton Bay*: MTQ-G56567, Peel I., IF, 2001; MTQ-G55321, G57797, Peel I., PLH, 1994; MTQ-G58439, Goat I., CCW, IF, PRM, 2005. *Fossil Moreton Bay*: MTQ-G56566, Empire Point, CCW, IF, PRM, 2003; recorded as subfossil from Mud I. by Wells (1955). *Living outside Bay*: QM-G7340, Flinders Reef, E. Lovell, 1972; QM-GL3849, Flinders Reef, E. Lovell, 1973–74; Flinders Reef, visual record CCW, IF, 2005. *Further south*: MTQ-G35073, North Solitary I., AIMS, 1978–1984; MTQ-G42345, Solitary Is, AIMS, 1978–1984.

Skeletal Characteristics. Mature colonies horizontal plates or series of plates arising from a central to side-attached stalk; younger colonies more obviously stalked with concave circular to oval upper surface ('crateriform'). Corallites oval, up to 5.5 mm greatest diameter, immersed or sub-immersed in mature colonies, in young colonies strongly exsert (up to 8 mm in Moreton Bay, up to 25 mm (Veron *et al.* 1979). Septa in three orders, the first two orders subequal and descending vertically, third order reduced or even absent, sides of septa granulated. Columella deep inside corallite, broad, spongy and strongly domed. Coenosteum and corallite walls a very dense arrangement of spinules.

Field Characteristics. Horizontal plates or crateriform colonies with very obvious large, deep corallites. Colour pale brown, pinkish-brown or grey; large polyps often expanded during the day and cream or grey in colour.

Distribution. Indo-Pacific from East Africa, Red Sea and Arabian Gulf to central Pacific. East Australia: Great Barrier Reef south to Solitary Islands, NSW and Lord Howe Island.

Remarks. This is the most common *Turbinaria* species in the bay.

Further Literature. Lovell (1989); Harriott *et al.* (1994, 1995); Veron (2000).

Turbinaria patula (Dana, 1846) (Figs 8C, 65)

Gemmipora patula Dana, 1846: 410. [Type locality: unknown].

Material Examined. *Living Moreton Bay*: MTQ-G58438, Peel I., CCW, IF, PRM, 2005. *Living outside Bay*: Flinders Reef, recorded Veron (1993); Flinders Reef, visual record CCW, 2005. *Further south*: recorded to Solitary Is (Harriott *et al.* 1999).

Skeletal Characteristics. Mature colonies include horizonal to oblique unifacial fronds, with internal sections of the colony also forming irregular columns as well as vasiform upright shapes with the corallites on the outside. Young colonies vasiform as they develop. Corallites tubular with oval calices 3–6 mm in diameter, the corallites on the columns reaching 30 mm in length and becoming very coarse and irregular. Columella broad and reticulate. Coenosteum reticulate with long, slender spinules.

Field Characteristics. Mature colonies as described above, reaching almost 1.5 m diameter. Colour pinkish-brown or pinkish-grey.

Distribution. Central Indo-Pacific and western Pacific. East Australia: Great Barrier Reef south to Solitary Islands, northern NSW, and Lord Howe Island (Harriott *et al.* 1995).

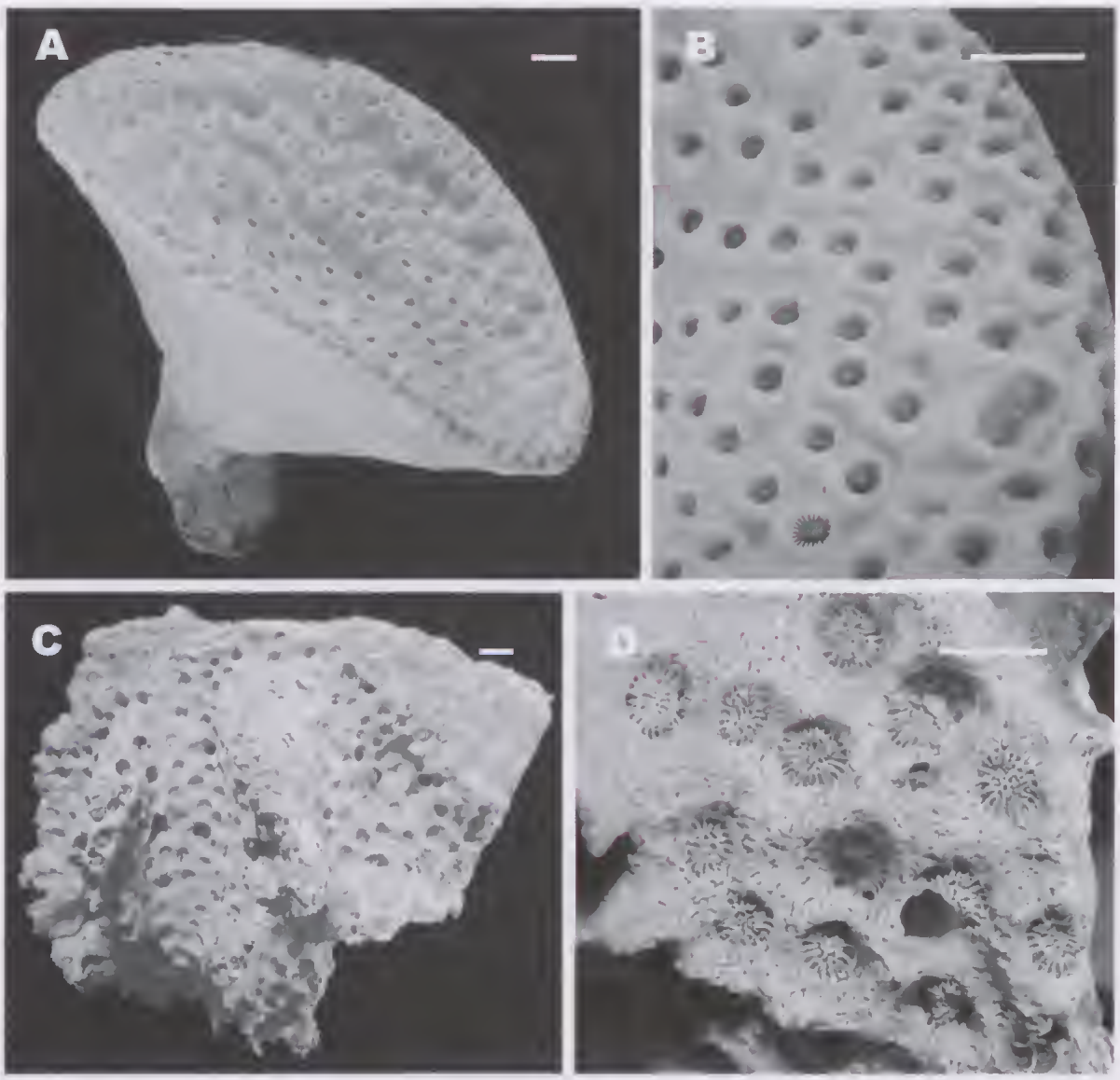

FIG. 64. *Turbinaria peltata*: A, B, from Peel Island (MTQ-G56567); C, D, fossil from Empire Point (MTQ-G56566). A, whole colony (maturing juvenile); C, portion of colony; B, D, close-up. Scale bars: 10 mm.

Remarks. This is the first record of *Turbinaria patula* from Moreton Bay; however the very large size of the colonies at Peel Island (over 1 m diameter in two cases) indicates that it is well established. The variation within a single colony from columnar and vasiform vertical projections to convoluted horizontal plates, with accompanying variation in corallite dimensions, is quite remarkable (see Fig. 65).

Further Literature. Banks & Harriott (1995); Veron (2000).

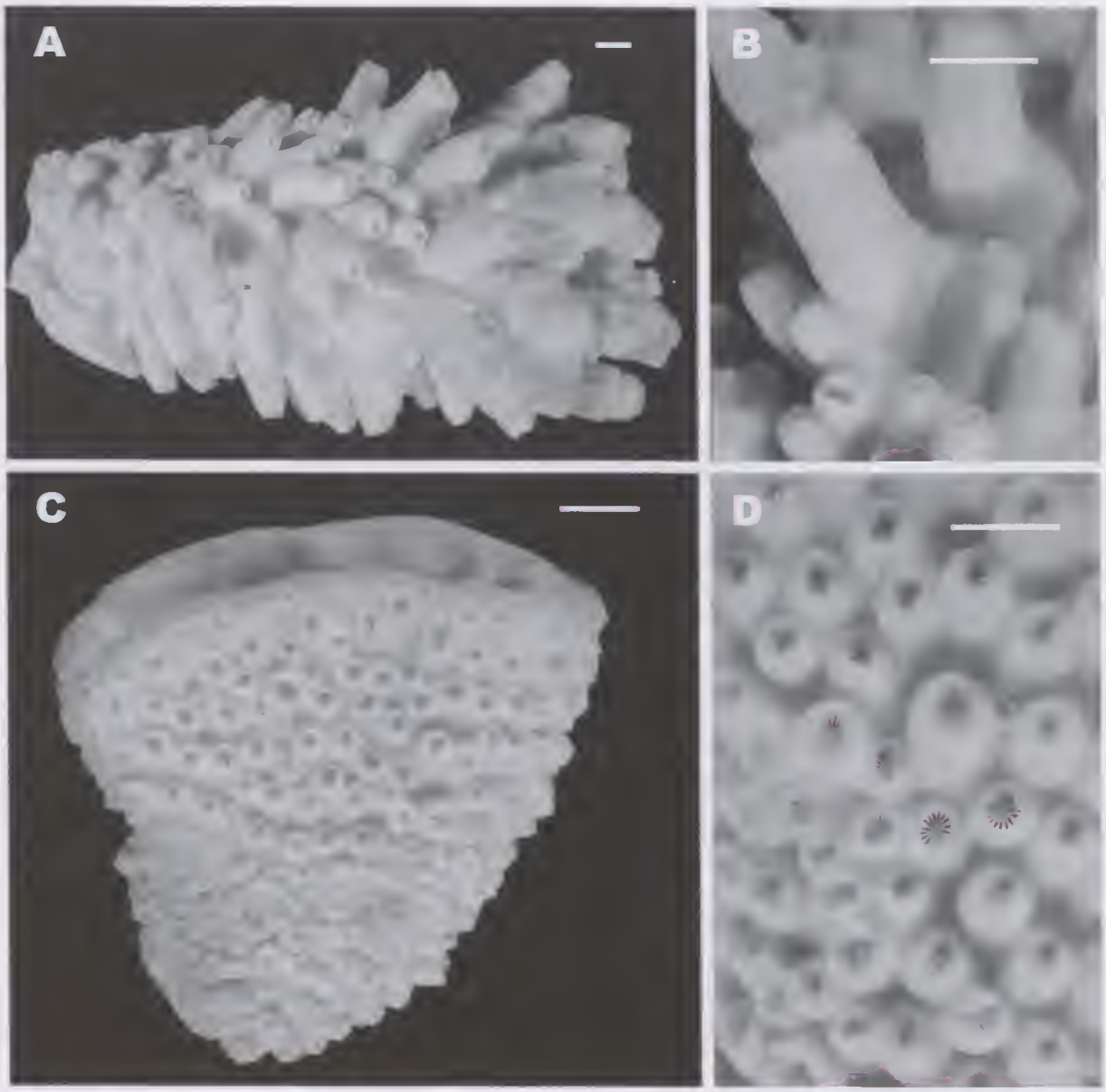

FIG. 65. *Turbinaria patula* from Peel Island, two pieces of same colony (MTQ-G58438). A, C, portions of colony. B, D, close-ups of portions respectively. Scale bars: A, C, D = 5 mm; B = 10 mm.

Turbinaria radicalis Bernard, 1896
(Figs 8D, 66)

Turbinaria radicalis Bernard, 1896: 43, pls 9, 31, fig. 18. [Type locality: Great Barrier Reef].

Material Examined. HOLOTYPE: NHM-92.12.1.668 (photographed F. Benzoni), Great Barrier Reef. *Living Moreton Bay*: MTQ-G56539, Peel I., IF, 2001; MTQ-G58440, Goat I., CCW, IF, PRM, 2005; MTQ-G58441, Goat I., PLH, 2005. *Living outside Bay*: Flinders Reef, recorded Veron (1993). *Further south*: MTQ-G42479, Solitary Is, AIMS, 1978–1984.

Skeletal Characteristics. Corallum circular and flat or irregularly domed, with tapering extensions of the undersurface coenosteum sent down as 'rootlets'. Corallites immersed or just slightly exsert, calices circular to oval, up to 2 mm diameter; septa 12–20, equal, with almost vertical inner margins and granulated sides. Columella elongate with a central ridge. Coenosteum reticulate with simple projecting spinules.

Field Characteristics. Rounded flat or domed colonies up to 300 mm diameter, 'rootlets' can sometimes be seen around colony edge. Colour pale lavender.

Distribution. Central Indo-Pacific and Western Australia and Pacific Ocean to Fiji. East Australia: Great Barrier Reef to S. W. Rocks, northern NSW, and Lord Howe Island (Harriott *et al.* 1995).

Remarks. This species was not previously recorded from Moreton Bay; however the colonies in this paper are substantial in size (up to 300 mm in diameter), and this indicates that it is now established at least in the southern part of the bay. Although the 'rootlets' are said to attach to the substratum, they are sometimes simply anchored in mud or rubble substrate.

Further Literature. Veron & Pichon (1980); Harriott *et al.* (1994, 1995); Veron (2000).

Heteropsammia Milne Edwards & Haime, 1848

Type species. *Heteropsammia michelini* Milne Edwards & Haime, 1848.

Diagnosis. Solitary, or colonial with small number of corallites resulting from intratentacular budding. Free-living, base enclosing tube of commensal sipunculid with several lateral openings through corallum. Wall densely reticulate; costae reduced to multiple rows of laterally flattened granulations. Septa following Pourtalès plan, lower cycles thick and spongy. Columella well developed. *Pleistocene to Recent.*

Heteropsammia moretonensis Wells, 1964
(Figs 7H, 67)

Heteropsammia moretonensis Wells, 1964: 118, pl. 3, figs 1–7. [Type locality: Moreton Bay].

Material Examined. PARATYPES: QM-G7119, QM-G7122, Pearl Channel, Moreton Bay; USNM-68383, Pearl Channel, Moreton Bay. *Living Moreton Bay*: MTQ-G55326, Moreton Bay, 16 wet specimens, M. Precker, 2005; MTQ-G55327, Moreton Bay, 10 wet specimens, E. Glover; MTQ-G55328, Moreton Bay, 26°56.5'S, 153°24.0'E, dredged, 41 m depth, 15 dry specimens, E. Glover, 2005; MTQ-G55329, Moreton Bay, 2 dry specimens, E. Glover, 2005.

Skeletal Characteristics. Solitary, free-living, cuneiform (laterally flattened with a wedge-shaped base); all specimens with a single polyp. Calices oval, measuring 4.5 x 5.0 mm to 8.0 x 9.0 mm in the samples observed. Height of individuals 1.2–5.0 mm. All individuals with one large hole (opening of sipunculid tube) plus 3 to 8 additional small pores around the base also associated with the sipunculid. Septa irregularly exsert, four cycles, S4 the largest, S4 > or equal to S1 > or equal to S2 > S3; septa without teeth, septal sides with very long granules which are densely and regularly distributed, no paliform lobes. Columella a dense arrangement of overlapping plates. Sides of corallite a dense reticulum of bulbous lines, regularly arranged.

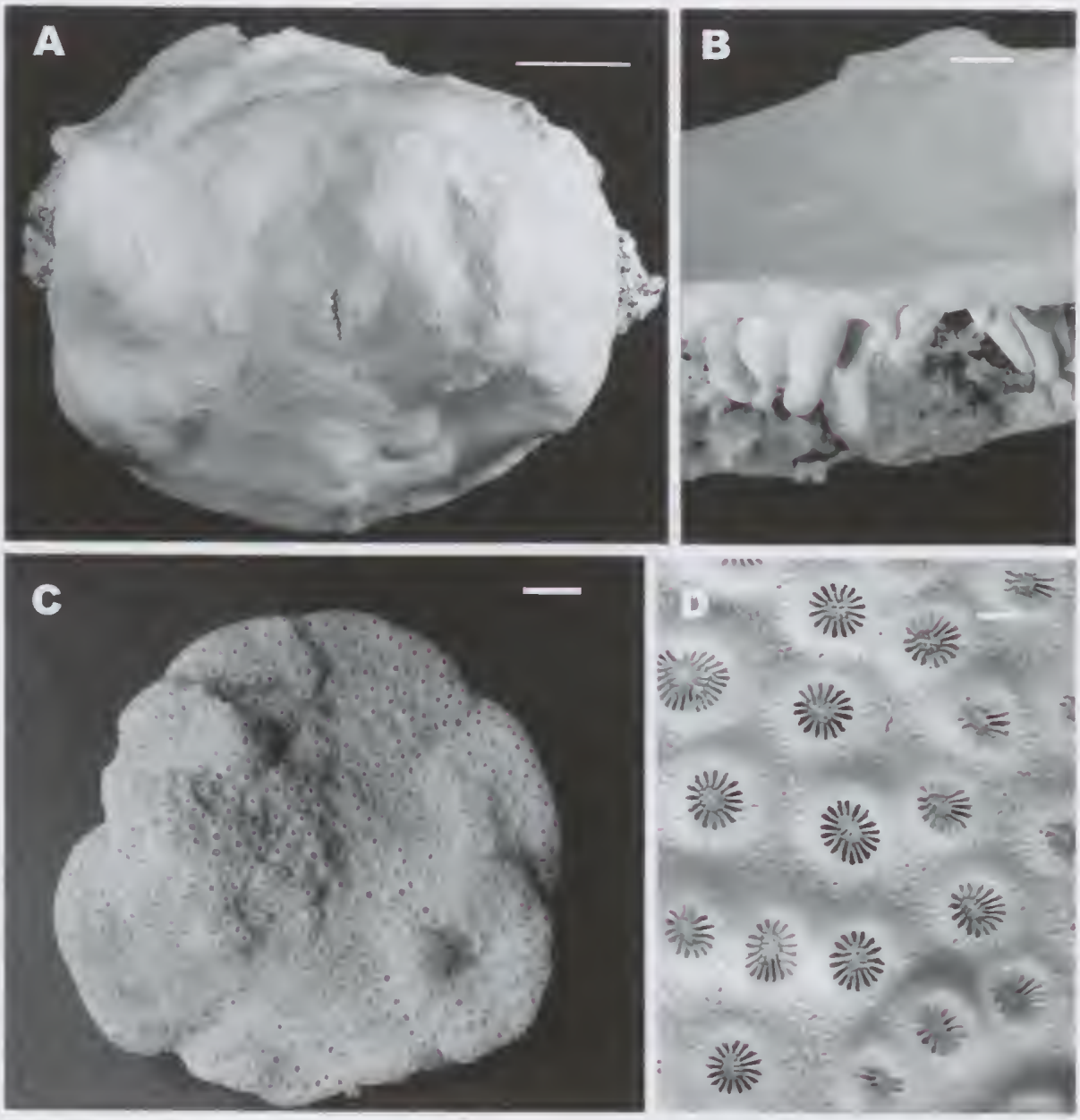

FIG. 66. *Turbinaria radicalis*: A, B, from Peel Island (MTQ-G56539); C, D, Holotype, Great Barrier Reef (NHM 92.12.1.668) (photograph F. Benzoni). A, C, whole colony; B, section of colony showing rootlets; D, close-up. Scale bars: A = 50 mm; B, C = 10 mm; D = 1 mm.

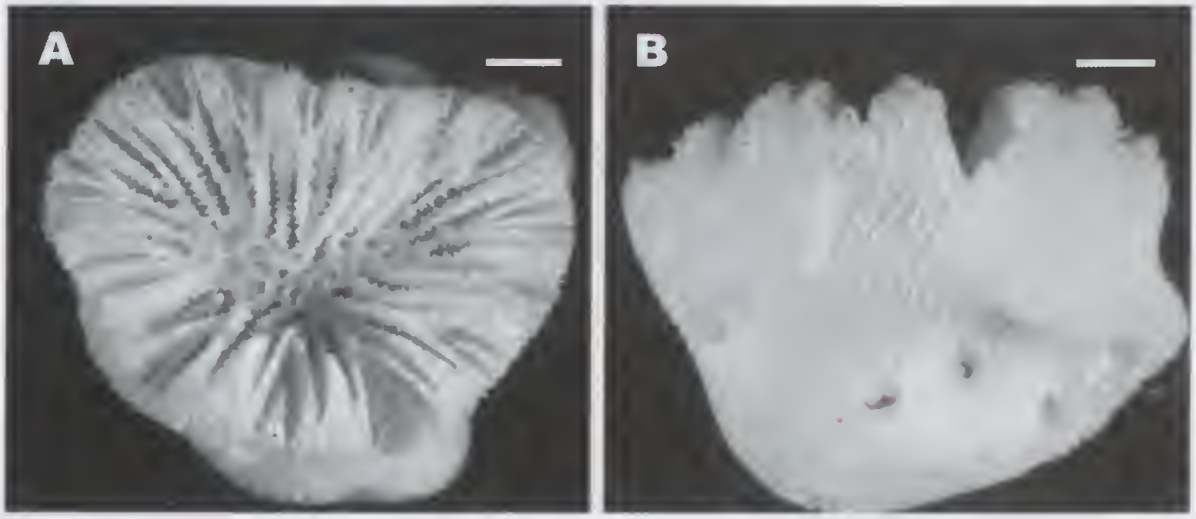

FIG. 67. *Heteropsammia moretonensis* from Moreton Bay (MTQ-G55328). A, corallum, top view. B, side and undersurface view. Scale bars: 1 mm.

Field Characteristics. A small solitary coral, apparently occurring in groups of many individuals. Colour bright salmon pink.

Distribution. Indonesian region, northern and eastern Australia. Eastern Australia: Abbot Point, north Queensland south to Moreton Bay region.

Remarks. This species has been interpreted as a synonym of *Heteropsammia cochlea* (Spengler 1871) by Hoeksema & Best (1991), and others. We here follow Cairns (2001) in regarding it as a separate species . This is based on its small size, bright salmon pink colouration and cuneiform shape, when compared with the larger sized *H. cochlea* whose adults are at least twice the size, have a more rounded shape, and have a tendency to divide to form a second calice. The two species have been found together in dredge samples from north to central Queensland (P. Arnold pers. comm.), but *H. cochlea* has not yet been found in Moreton Bay.

Further Literature. Hoeksema & Best (1991); Cairns (2001, 2004).

CARYOPHYLLIIDAE Gray, 1847

Diagnosis. Solitary or colonial. Colony formation by extratentacular budding forming phaceloid or dendroid colonies. Septa laminar with smooth or nearly smooth margins, composed of one fan system of small, simple trabeculae. Costae commonly covered by stereome or epitheca. Septa exsert. Columella formed by curled trabeculae, solid, spongy or absent. Pali or paliform lobes common. Endothecal dissepiments present in some groups. *Jurassic to Recent.*

Heterocyathus Milne Edwards & Haime, 1848

Type species. *Heterocyathus aequicostatus* Milne Edwards & Haime, 1848.

Diagnosis. Solitary, fixed at settlement to small gastropod, later completely covered by corallite base except for openings communicating with habitation of commensal sipunculid. Costae extending over the base as granulations. *Pliocene to Recent.*

Heterocyathus aequicostatus Milne Edwards & Haime, 1848
(Fig. 68)

Heterocyathus aequicostatus Milne Edwards & Haime, 1848c: 324, pl. 10, fig. 8. [Type locality: unknown].

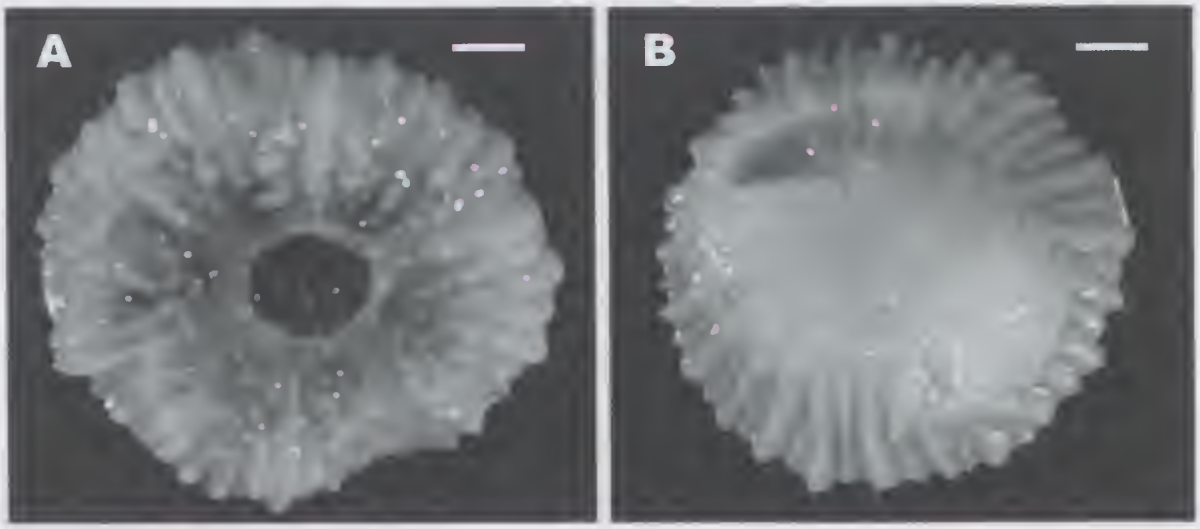

FIG. 68. *Heterocyathus aequicostatus* dredged from 41 m, Moreton Bay (MTQ-G55331, wet specimen). A, corallum; B, undersurface. Scale bars: 1 mm.

Heterocyathus roussaeanus Milne Edwards & Haime, 1848c: 324–325, pl. 10, figs 9–9a.
Heterocyathus cochlea Gray, 1849: 77, pl. 2, figs 1–2a.
Heterocyathus hemisphaerica Gray, 1849: 77, pl. 2, figs 3–4.
Stephanoseris lamellosa Verrill, 1865: 149; Verrill, 1866: 46–7, pl. 2, figs 4–4a.
Stephanoseris japonica Verrill, 1866: 47–48.
Heterocyathus oblongatus Rehberg, 1892: 9, pl. 2, figs 1–2.
Heterocyathus woodmasoni Alcock, 1893: 141–142, pl. 5, figs 4–4a.
Stephanoseris carthausi Felix, 1913: 332–333, pl. 27, figs 9–9b.
Heterocyathus elberti Felix, 1913: 363–364, pl. 27, figs 1–1c.
Stephanoseris typicus Folkeson, 1919: 11, pl. 1, figs 12–15.
Heterocyathus elongatus Hu, 1987: 39–40, pl. 1, figs 17–18.
[synonymy adapted from Hoeksema & Best (1991); fossil species omitted].

Material Examined. *Living Moreton Bay*: MTQ-G55331, Moreton Bay, 26°56.5'S, 153°24.0'E, dredged, 41 m depth; 2 wet specimens, E. Glover, 2005.

Skeletal Characteristics. Corallum height 4.2–4.5 mm; calice diameter 5.2–4.5 mm, single, round corallite opens at top. Undersurface flat, granulated and with a large hole at one end and smaller hole at the other. Septa exsert, of irregular height, top rounded and with very large tooth-like granulations. Costae alternating large and small, both with evenly distributed, large, rounded teeth but the larger costae having two rows of teeth.

Field Characteristics. Small rounded individuals comprising a single polyp with a rounded opening. Polyp extended during the day. Colour blackish-grey.

Distribution. Eastern Indian Ocean, Central Indo-Pacific including North Australia, and northern Pacific to Samoa. East Australia: Great Barrier Reef to Moreton Bay region.

Further Literature. Crossland (1952); Stephenson & Wells (1956); Wells (1964); Zibrowius & Grygier (1985); Hoeksema & Best (1991); Cairns (1998); Veron (2000); Cairns (2004).

FLABELLIDAE Bourne, 1905

Diagnosis. Corallum solitary, fixed or free, ahermatypic, Wall epithecal, thickened internally by stereome. Septa non-exsert, formed by one fan system of simple trabeculae. Pali and dissepiments absent. Columella present or absent. (Adapted from Wells 1956). *Cretaceous to Recent.*

Flabellum Lesson, 1831

Type species. *Flabellum pavoninum* Philippi, 1841.

Diagnosis. Corallum ceratoid, campanulate, or highly compressed, base not reinforced with stereome. Wall epithecate, bearing fine, chevron-shaped growth ridges that peak at major septa; no costae. Columella rudimentary, consisting of a fusion of inner edges of lower cycle septa (from Cairns 1995). *Eocene to Recent.*

Flabellum knoxi Ralph & Squires, 1962 (Fig. 69)

Flabellum knoxi Ralph & Squires, 1962: 14–15, pl. 7, figs 1–2. [Type locality: New Zealand].

Material Examined. *Living Moreton Bay:* QM-G5339, off Cape Moreton, 110–137 m, D. Harris, 1969.

Skeletal Characteristics. Individuals fan-shaped with pointed central base, greatest width 40–59 mm; calice laterally compressed. Epitheca and lines of septal insertion visible on outer surface of wall. Septa non-exsert, 192–268 per individual. Septa in three cycles: first reaches the columella, second reaches 2/3R, last reaches 1/3R. Columella a line of slightly curled thick trabeculae.

Field Characteristics. Fan-shaped individuals, apparently occurring in groups of many individuals.

Distribution. New Zealand and Moreton Bay. East Australia: Moreton Bay.

Remarks. This species has been previously identified as *Flabellum rubrum* (e.g. by Wells 1955). The current identification was by M. Kitahara and verified by S. Cairns. It is the first record of this species for Australia.

Further Literature. Cairns (1995).

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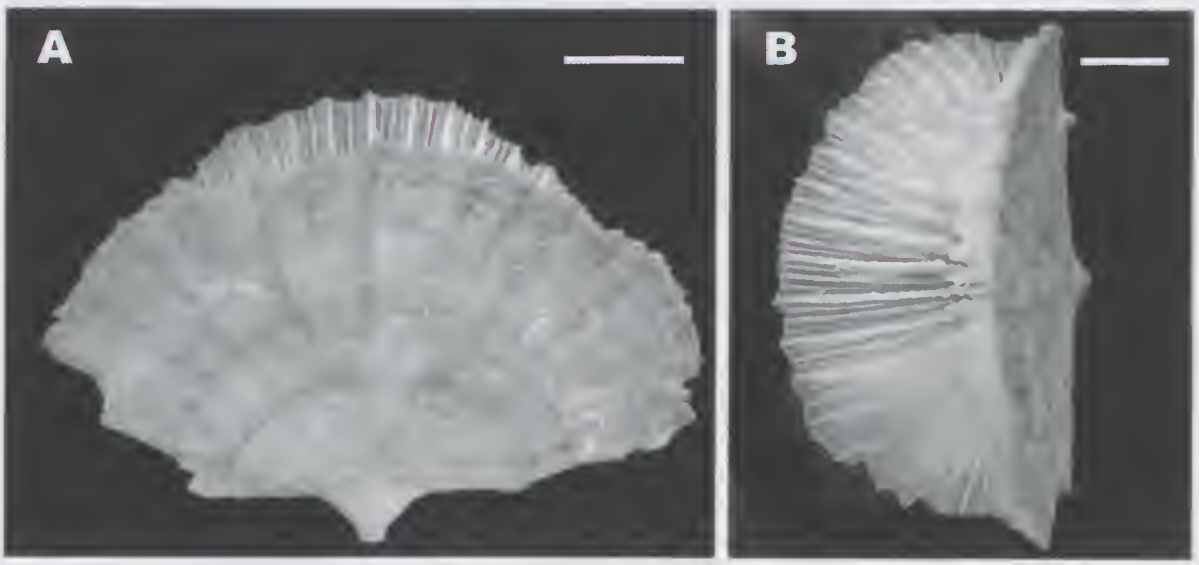

FIG. 69. *Flabellum knoxi* trawled off Cape Moreton, 65-70 fathoms (118-128 m) (QM-G5339). A, side view; B, upper surface. Scale bars: 10 mm.

and taxonomic detail) Emre Turak, Marcelo Kitahara and Francesca Benzoni (advice on taxonomic detail); Frances Michaelis (editing); members of Moreton Bay research station staff; H. Fukami of Kyoto University, Japan, who worked with CCW and PRM in 2007; F. Benzoni and M. Pichon who photographed and examined types in the MNHN and NMH; David Parkhill and Meg Lloyd at QM Library for bibliographic assistance. We thank the museums that lent us type specimens (indicated in systematic text). Finally we are very grateful to Peter Davie and members of the organising committee for the Thirteenth International Marine Biological Workshop for their invitation to attend, and for invaluable field and laboratory support.

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